JOURNAL OF GAS LIGHTING & WATER SUPPLY.

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VOL. CXXX., No. 2714.] TUESDAY, MAY 18, 1915. [67TH YEAR.

EDITORIAL NOTES.

The War and Institution Work.

THE war has had an effect upon the complexion of the annual report of the Council of the Institution of Gas Engineers. It is not quite so voluminous as usual; but there is no falling away from the number of subjects dealt with. Throughout, however, there are the tracks of war influences on the year's work, which has called for energy and application of an unusual order from the President (Mr. John Bond) and the Council. To the calls they have responded, on behalf of the industry, generously and with personal sacrifices, and without indulging unnecessarily in those formularies that restrain action and waste time. There is in a general way too scrupulous a regard for form and rule; but the year has shown that the shackles can be shaken off on occasion. The President and the Council, in the course of the year, have been of considerable use to the War Office and the Admiralty; and the gas undertakings of the country have been able to contribute materially, in both ordinary and devious ways, to the equipment of the Army and Navy and to the supply of essentials to the making of explosives, and in increasing quantity as the war has progressed. Of this note is made in the opening of the report; and later there is reference to the information collected for the authorities as to the resources of the gas industry in the matter of providing raw material for the production of synthetic dyes and colours for the home industries in need of them.

The action, too, that the Council took in regard to tar prices, and what they have been doing in respect of coal supplies, including the part taken in organizing the successful conference of the gas and electric industries, are also exceptional features of the year's work due to the unhappy international conditions. It is true the Council's action in regard to tar prices had an abortive ending, but this was not their fault. It has yet to be seen whether the representations and the conferences as to coal supplies have had substantial influence or otherwise. The Council also intervened on behalf of the gas industry in the matter of railway traffic, and the uncomfortable heavy commandeering of means of transport both by sea and land, as likewise in connection with the recruiting among gas employees, which, through the desire of the men of the industry to serve King and country in the war, was threatening to jeopardize (with all the goodwill of the men left behind in trying by their own labour to fill the gaps) a full gas service. The Council have, in short, had a very useful existence during the year, through being able to render help in extraordinary circumstances; and for what they have done, and have attempted to do, they deserve the recognition of not only the gas profession, but of the industry generally.

The war has left other marks on the year's work. We see them in the numbers of candidates that presented themselves for examination in "Gas Engineering" and "Gas "Supply," in contrast with the numbers of the preceding year. Officers and men have gone forth from gas-works to serve the country in a larger and more hazardous field; and to this may be attributed the fact that Mr. Samuel Glover was only able to report 166 candidates for the "Gas En- "gineering" examination, as compared with 295 the year before, while Mr. Walter Hole had 343 candidates in "Gas "Supply," in contrast with 671 the year before. These figures tell a tale; for there was no reason other than the call to arms for such a large falling-off in the numbers of candidates. Speaking of examinations, it is safe to say that Mr. H. Kendrick and Mr. Ralph Halkett, the Examiners in "Gas-Fitting," would have inaugurated their work in this connection with a greater number than 257 candidates had circumstances been otherwise; but considering the circumstances, and the fact that these examinations are an innovation, the number of candidates is really surprising. In other directions, too, work has been affected by the war. At the formal business meeting to be held next month in lieu of the usual annual meeting, it appears probable the only forthcoming report of any pretensions on technical work will be one from the Ventilation Research Committee. This will be the first break in the line of most useful and interesting reports from the Refractory Materials Research Committee since their appointment—owing primarily to the absence of the energetic Honorary Secretary (Captain F. J. Bywater) and Major H. W. Woodall, and, secondly, to the late delivery of the apparatus required for carrying out the investigations arranged for the year. But there is much interest for anticipation in the results of the various experiments that Dr. J. W. Mellor has in hand as to the effect of high temperatures on fire-clays and refractory materials under load, as well as of the investigations into cement jointing material for retort-settings, and into the difference in size of whole bricks from different sources when cold and at high temperature.

The work of the International Illumination Commission has also been, and will continue to be, somewhat hampered by the present obstacles to intercommunication. But the home section has held a sitting, when it was resolved that it is desirable that a uniform international method should be adopted for the rating and marking of all sources of light. The desirability depends upon whether a rational method is devised. If marking and rating are to rely alone on gas consumption or on electrical input (as some of the electric lamp manufacturers would prefer) without reference to value obtained, then there would be room to question the correctness of the application of the word "desirable." It is also remarked that the standard street-lighting specification (which would be of precious little use under current circumstances) has not yet assumed definite shape. But the intelligence is given that the advocates (representing the gas industry) of an amendment of the draft specification by the substitution for minimum illumination expressed in foot-candles of candle power as determined by direct readings at specified angles failed to secure a majority of adherents. The proposal therefore goes. Certain modifications have, however, been made, providing for the inclusion of the maximum as well as the minimum horizontal plane illumination (the one being within definite limits of ratio to the other), and for some specified control as to the height of the lamp columns. The details of these modifications have yet to be discussed.

Among the other items of information in the report, we are glad to see that the conditions on which the Corbet Woodall Scholarship will be awarded have been framed, and that the scholarship is identified with the University of Leeds. Candidates will find that compliance with the conditions will not be a difficult matter. Appropriate in this connection is a word of congratulation to the Council and the Junior Gas Associations. The fairest thing the former have done in connection with the awarding of medals for last year's papers is the bestowal of the London Gold Medal on Mr. George T. Purves (an able representative of the junior organizations) for his paper treating of coke-oven practice and the direct recovery of ammonia.

Production of Competent Chemists and Investigators.

A GRATIFYING and promising feature of the past few years has been the considerable development in the provision of opportunities for the study of, and research into problems associated with, the use of solid, liquid, and gaseous fuels, the carbonization of coal and the distillation of oil, and the improvement and utilization of the derivatives of the carbonization and distillation processes. Time was, and it is within the memory of many of us, when the processes in which coal and oil are largely employed as the fuel or as the raw material were conducted in an empirical manner; but as scientific culture has been brought to bear on these

processes, crudity has been gradually dispelled until more economic, and therefore more profitable, conditions prevail. What has been accomplished hitherto, though immense in the aggregate, has only really pointed to the combination of science with industrial work having within it a vast and unassessable potentiality. Slowly but increasingly manufacturers—those of the gas industry among them—are recognizing this to their advantage, though even now, except in a relatively few undertakings, there is good ground for criticism as to the place and pecuniary reward accorded to scientific work.

To a very large extent (we suppose because it has grown on to, and was not an original part of, the operations) the chemical work that is usually carried on in a gas-works is to-day merely in the nature of a routine and limited control. This is not the case in connection with most bye-product coking plants northwards, whatever it may be in other coal areas. Such plants started with chemical control and research as part and parcel of what was necessary to economy and development. What we should like to see is every undertaking that can afford it with sufficient qualified assistance in chemical and physical work to enable something more to be pursued than a humdrum day-by-day round, however essential; and though this would cost a little more money, it would, we are confident, be money well spent. While there are exceptions, generally speaking the chemical assistants on gas-works are poorly paid, and yet, in their hands and upon their work, rests a very large responsibility. They are given little of that encouragement which induces zeal and ambition, and there's the pity. The result is that there are undertakings the chemical work of which, or what passes by the name, is simply carried on by youths who have had no training other than that picked up within the four walls of a gas-works laboratory, and who are not of any use for anything other than the daily routine testings. There are things that are in several quarters sadly in need of rectification. The work of the gas industry in respect of raw materials, products, utilization of products, control of processes, and qualitative examination—chemical and physical—of much of the material used on gas-works, offers scope for the employment of first-class trained men. But the gas industry must make it worth while for such men to devote their lives to its service. There is room for amendment in the industry in this connection.

Trained men—men capable not only of giving chemical supervision to such processes as are conducted on gas-works, but men whose training in chemical and physical work qualifies them for research to the end of securing improvement—are being produced in the various institutions that have set themselves the task and duty of developing higher efficiency in men. The view was at one time widely held that men so trained were, in their own estimation, superior persons, that they would be misfits in any class of industrial establishment, and that their work was of such finical character that it could never be translated into practical and material use. This view is vanishing; and a good thing too. It would the more quickly vanish if those who hold it would only go to, and spend a few hours in, the Fuel Laboratories of the Chemical and Technology Department of the Imperial College, of which we give an extended illustrated description this week, together with information as to the character of the work present and prospective that is being and is to be carried on there, under Professor W. A. Bone, D.Sc., Ph.D., F.R.S. Upon the organization of these laboratories, we heartily compliment the Governing Body and Professor Bone, who has had the responsible but agreeable task of laying the foundations of the department, and directing its operations into those channels that are considered the most beneficent in promoting the capacity of the men who are fortunate enough to come under the broad (post graduate) course of training and work that the laboratories, their equipment, and their staff afford. The work is conducted on such practical lines, with the view that it may serve practical ends, that if a man does not step from the laboratories at the end of his term equipped with knowledge and fitness that will enable him with growing experience to be of larger and larger use in the scientific and industrial worlds, then it will not be the fault of Professor Bone and his assistants, lecturers, and demonstrators. Only want of personal capacity or indolence could possibly yield a failure here; for the provision has never been equalled, and is unsurpassed, in this great Metropolis of ours for carrying on the special work of producing higher competence in men for taking part in the securing and the maintaining of the greatest economy, and promoting advances, in industrial processes in which fuels of any kind are employed, or in which these same fuels constitute the raw materials.

In the descriptive article elsewhere, there is a large amount of information as to the buildings, the wealth of their equipment, the essential qualifications of intending students, the scope of the work, and the plans for future research. If the scheme meets with the success it deserves, the right men will be turned out for industrial needs in the matter of real scientific work; if the plans for future researches that Professor Bone has in mind, and is preparing for, are consummated, then there should be much valuable result for, among others, the gas industry, for the furtherance of the success of which industry additional knowledge is required not only regarding its carbonizing processes and the larger recovery and treatment of residuals, but respecting gas compositions, the combustion of gases of different compositions, and the development of flame temperatures. We are catholic in the gas industry, and welcome open-armed all schemes and all work, wherever promoted, which promise to confer upon it increasing benefit.

The Bone-Callendar-Yates Bolometer.

In one of the laboratories of the Department of Fuel and Chemical Technology of the Imperial College of Science, a demonstration was made before an interested number of visitors last Wednesday of the Bone-Callendar-Yates bolometer for the measurement of the radiant efficiencies of gas-fires and other incandescent surfaces. There was also, as mentioned elsewhere, a general explanation given, by Professor Bone, of the construction and working of the new instrument. What the investigator-inventors have been aiming at has been the elimination from the testing of radiant efficiencies of errors and uncertainties, and the production of an instrument highly sensitive and accurate in action. It is being straightway largely accepted that what the investigators sought has been attained; for, as Professor Bone suggested, no one can imagine Professor Callendar putting his name to anything of this nature that is not efficient, and cannot sustain in practice the character ascribed to it.

A point that is an open question now is what is going to be done in the matter of the revision of the Leeds test. It is conceded that there are defects associated with the Smith water-tube radiometer used in the test; but the radiometer does not by any means cover all that is assembled under the descriptive term "Leeds method" which has obtained currency in referring to this question of the testing of gas-fires. There are one or two other radiometers in existence that have surmounted the defects in the water-tube radiometer, have simplified radiant efficiency tests, and have produced much greater accuracy and an economy of time. The Bone-Callendar-Yates bolometer, it appears, has aspired to something more than these improvements. This being so, and the claims for it and the new radiometers being what they are, the Leeds standard, so long as it incorporates anything now acknowledged to be defective (though the best known at the time of its institution), cannot be regarded in the same light as formerly. But, of course, there cannot be revision of the standard method in any particular without prior investigation of an independent order into the claims of the new comers. The men, too, who are engaged in the works of gas-fire manufacturers or in the testing laboratories of the works of large purchasers of gas-fires, will be glad to have the claims independently reduced to a comparative level. In the case of the gas-fire maker, he, of course, requires the greatest degree of accuracy possible in the tests on which he bases his claims, in order that he may be able to defend them. But for ordinary works' control tests, such absolute accuracy is not essential, and buyers do not, as a rule, want anything more than a system of testing to enable them to make comparative efficiency determinations. The need for independent investigation is clear; and the sooner the better, for we do not want the results of tests to be variously rendered now—some obtained under the Leeds method, others under that method with one of the new radiometers, and others by the use of the bolometer.

But, of course, it goes without saying that, if an instrument exists which gives high accuracy, combined with economy of time, and asks for the minimum of attention, this instrument will be preferable to one that does not aspire to the same perfection in point of accuracy, and yet also economizes time. The bolometer method does claim a high degree of accuracy; and with the instrument, after a fire

has been alight sufficiently long to settle down to normal work, a test, it is stated, can be completed in half an hour, so that two fires can be tested in an hour, if both have been allowed to run sufficiently long to attain normal conditions. In considering the question of time economy, there is the fact to be taken into account that the bolometer can be used with a recording instrument; so that testing, when once the bolometer and a fire have been placed *vis-à-vis*, and set to work, can go on automatically. These are points to be brought into reckoning with others, such as suitability under works' conditions, which are not of the refined order found in the professorial laboratory. There is also the question of cost of equipment, and other matters. At the demonstration last Wednesday, surprise was expressed regarding the smallness of the bolometer, and of the absorbing surface—only 2·89 square inches—which enables the instrument to be calibrated from a standard source of radiation. The instrument, including all the necessary equipment, is portable. The various features put forward in its favour are all of importance. But every parent naturally presents for admiration the best points of his own offspring; and, as before remarked, what is wanted is that the claims of the various aspirants for favour in connection with this testing of the radiant efficiency of gas-fires or other incandescent bodies or surfaces should be sifted out, and placed in their proper relative position, by some independent competent person. There will soon be opportunity for doing this—for arrangements are now being made for the manufacture of the bolometer, and no doubt the same thing is being done with at all events one new form of radiometer, which has lately been put before the gas profession.

Official Municipal Targets.

A LARGE amount of approval has been expressed regarding the attitude taken up by the "JOURNAL" in the matter of the Stoke-on-Trent invitation for applications for the position of Chief Gas Engineer and Manager, and the proposed reduced conditions in the matter of pay, &c. Obviously our correspondents being in municipal service are not in a position to avow openly their feelings regarding what has now become the too common course taken by a proportion of the members of councils of attempting to depreciate in the eyes of the public the management of officials, of subjecting officials to petty annoyances, of offering on every possible occasion resistance to any addition to their emoluments (forsooth some municipal officials deserve extra compensation for the annoyances and even insults to which they are exposed by some councillors!), and of never losing an opportunity for attempting to subvert discipline by publicly questioning the acts of officials. There are many municipal councillors above all this sort of thing, and who treat officials as men and with the courtesy that their position and service should command. It is the others—those who entirely lack, if we may take their actions as the basis for judgment, all those personal qualifications which combined go to make for good administration in local government—who take advantage of their position so as to promote irritation, in the belief that popularity lies in the direction of public attacks on the official element in the municipal organization. They never made greater mistake. Popularity may be thus gained among a certain small section of the public; but official annoyance and the making of official service unbearable are not the ways to promote and produce the legitimate end of municipal administration of trading concerns, which is the yield of as large service as possible to the community, and on the best attainable terms.

The results of the policy of those who make the officials the targets for their vulgarities are the sapping of ambition and interest, the deterioration of managerial efficiency, and a drifting, as fast as opportunity will allow, from municipal to company service. One has only to look round the country to see the number of men who have—many of them thankfully—shaken the dust of municipal service from off their feet to pass to the less harassing, and therefore more congenial, service under companies and boards of directors, from whom they receive the proper and respectful treatment due to their position and efforts. The difference between official comfort under company and municipal management is traceable entirely to the difference in the constitution of boards of directors and municipal councils. The directors of gas companies are usually either business or professional men, and are financially interested in the concern. But the composition of a municipal body—well, it ranges from men who know how to treat their fellow men to men who are fanatics, or else have an axe to grind, or have no sense of consideration for their superiors in intellect and ability, or have no understanding regarding what is due from them in the matter of behaviour. However, although intercourse between gas officials and directors is of a friendly and encouraging nature, we find that the results of the working, the extent of public service, and the happiness of the relations between men and their chiefs and employers are usually on a much higher level than where there is municipal ownership. It is a reproach to municipal administration that this should be so. The Board of Trade returns bear witness to greater progressiveness, speaking generally, in the case of gas companies than in the case of municipalities taking the average (for there are pronounced exceptions); and there has not been the trouble among company-employed gas workers that unfortunately there has been of recent times among those in municipal employ. The men in the latter are encouraged by the policy and public performances of some of the councillors to rebel against working law and order; and under any pretext in these times they will do so. Though many municipal officials have migrated to company service, there are, of course, some company boards who prefer to have a company trained man as their chief official rather than one who is seeking early release from the trammels of municipal service. One correspondent tells us that this was the case at Southend—that all municipal applicants were finally struck off the list. If gas company directors do not desire to have a municipal man, they might say so outright in inviting applications.

However, that by the way. We have lately witnessed trouble at Blackburn, Neath, and Huddersfield—all with municipally controlled gas-works. We have seen what has occurred at Stoke-on-Trent. What has been done at Huddersfield in filling up the appointment of Gas Engineer and Manager, and what is proposed at Stoke-on-Trent in the matter of reducing the advertised emoluments of the Chief Engineer and Manager cannot but create misgivings in the minds of officials in some municipal service. They must always have about them a sense of insecurity—of never knowing what is going to happen next—to the disturbance of their peace of mind, and naturally to the disadvantage of their working efficiency. We have just been reading, too, a report of the proceedings at a recent meeting of the Birkenhead Town Council, when various petty matters were raised in connection with the recent strike at the gas-works, and when a suggestion was made that there should be a general inquiry into what is stupidly called the "mismanagement" of the works. On the same occasion, too, a proposal was referred back, that some monetary recognition should be made of the services of those members of the staff who had worked day and night in order that Birkenhead might have its supply of gas. All this because of what? Because the officials happen to be the first with whom the men and their union leaders come in contact in preferring claims—whether reasonable or otherwise; and because a few coppers per man per day were spent on beer during the strike for the "Tommies" who were sent in to protect the works, and this at the instance of their commanding officer. The councillors who raised these questions (the one referring to the beer is considered of sufficient importance by the Secretary of the Gas Workers' Union to raise in the House of Commons!) ought to be ashamed of their own paltry and miserable action.

But look round. To what is all this parsimony, distrust, and interference with the functions of management leading? To the degradation of municipal official service, and to self-respecting men holding aloof from municipal service (unless it be of good repute) while they can find employment for their talents elsewhere. One of our correspondents considers the time has arrived when a Municipal Gas Engineers' Protection Society should be formed for the purpose of defending the interests of officials against votemongers and others. He says that such an organization, though it savours somewhat of trade unionism, is badly needed, seeing that it is only by cohesion that municipal gas officials can force respect for their rights by "degenerate councils." He further declares that the Institution of Gas Engineers does nothing for its members in this connection, nor do the District Associations; and therefore something must be done of an independent character by the officials themselves. Fancy professional men, through being officials of municipal bodies, having to descend to even the suggestion of amalgamation for the protection of their individual rights! This is

all due to the deterioration of the composition of municipal administrative bodies; and it is not a happy thing for the smooth working and the highest efficiency of the local governing machine.

Manchester Heating Comparisons—A Warning.

In the "JOURNAL" for the 4th inst. (p. 278), there appeared an account of some comparisons made at the Manchester Town Hall, with a view to ascertaining the practical effects of substituting gas-fires for coal-fires in the Committee-rooms. The tests were made by Mr. Harold Wood, a member of the Council; and the results led to the Town Hall Committee recommending the use of gas-fires in place of coal-fires in rooms—the Committee rooms for example—where intermittent heating is required. It will be remembered that for rapidity of heating, constancy, labour saving, and economy of cost per degree rise of temperature, the gas-fires were the superior of the coal-fires. The tests were not put forward on any higher ground than as a rough comparison under similar conditions of the two methods of heating. As for scientific accuracy, there was not the slightest pretence of that. This being so, it would unquestionably have been better had the comparative figures given in the report not been published. In no place in the report are any particulars recorded which enable one to judge as to the conditions under which the comparisons were made. There is no information about the dimensions of the rooms, and other factors are missing that are necessary to enable any fair judgment as to the value of the figures. Thermometric measurements, too, in rooms where there may be variable draughts playing on the instruments are not dependable in arriving at the relative efficiency of the means of heating. "Tests" under the circumstances is a misapplied term; and really, on the figures as they stand, nothing approaching the difference of efficiencies set forth in them could be found even if the worst type of gas-fires in existence were being compared with the best. Therefore, it will not do to take as authoritative the figures in the report. The readings, it will be seen, were made by one of the Town Hall staff; and there was nothing about the comparisons that give them acceptance for technical soundness. A word of warning, it has been suggested to us, is perhaps requisite, to ensure that the figures have no undeserved value placed upon them; but the general conclusions first referred to in this paragraph are quite justified under any circumstances with any gas-fire constructed on approved and modern lines.

Gas-Works Owned by Local Authorities.

In the last two or three issues of the "JOURNAL," there have appeared some of the first reports to arrive dealing with the operations of municipally owned gas undertakings during the financial year lately closed. These reports are, of course, while eminently reassuring from the point of view of the soundness of the industry, in most respects of a less favourable character financially than has been the case on various recent occasions. The war has adversely affected the consumption of gas in many districts, and the returns from residuals in practically all; while the high price of coal has been the governing factor making for decreased profits, and the cost of other materials and of labour has also pursued an upward course. The existence of this state of affairs is being very generally reflected in an increased charge for gas. Sales of gas at Bradford show some falling off; and the income from residuals has been much smaller. The result is a deficit of £27,000, compared with one of £800 for the previous year. It was stated in the Brighouse Town Council that the Gas Committee, who had been expected to contribute £700 to the relief of the rates, found themselves with a profit of no more than £50. Increased costs and diminished prices for residuals were accompanied by a decrease of 2½ per cent. in sales of gas. In the case of Dukinfield a decrease of some 4 per cent. was experienced in the sales of gas; and a gross profit of £3000 the previous year is replaced by a sum of £1100 on the present occasion.

Working Results.

The Lincoln City Council are to receive from the gas undertaking £3000 less than twelve months ago; while at Manchester (though the city fund is to get the £50,000 which had been arranged) the actual gross profit for the year just ended amounted to £90,369, compared with an estimate of £119,571. The quantity of gas delivered at Nelson exhibits a decrease of 6¼ per cent.; the result of the year's working being a net profit of £5299, against £7866 the preceding year. A reduction in the amount of gas sold is also reported from Nottingham, where, however, the same substantial sum (£39,000) is to be devoted to the relief of the rates as was taken from the undertaking a year ago. Oldbury, on the other hand, has been enabled to send out a substantially larger amount of gas during the year. A profit of £3500 in the case of Rochdale compares with a surplus of nearly £10,000 for the preceding year. The rates will have no relief from this source at the present time, as it has been decided that the whole of the profit should go to wiping-off an adverse balance on the reserve fund. A record make of gas was experienced at Rotherham, where the sales show an increase of practically 3 per cent.; and, in spite of the adverse circumstances, the net profit is almost the same as a year ago. Stafford exhibits a net profit, from which the rates are to benefit. Stalybridge this time reports a loss; but for a number of years past goodly sums have been handed over in aid of the rates. The report from Todmorden is a satisfactory one; and a substantial increase in sales took place at West Bromwich.

Compensation and the Cost of Living.

The increased cost of living has, as has been noted from time to time, led to the granting of war bonuses—or temporary increases of wages—to employees in all kinds of work, including the gas industry. But a case does not immediately come to mind in which concessions of this character to workmen have been the cause of increasing sums paid under the provisions of the Workmen's Compensation Act. The question of whether a man in whose favour an award has been made is entitled to an increased amount when higher wages are given to meet the heavier cost of living has, however, now arisen; and as it may come forward in the same or some similar form in other quarters, the facts and the decision may be briefly noted. In connection with a claim, in the Leeds County Court, on account of an accident which occurred about six years ago, a man asked the Court to grant him an additional sum which he said he could have earned for the past two years, because of an advance which had been made, owing to the increased cost of living, to men occupying a similar position to his. The advance referred to was not a war bonus, as it was given to the men long before the war was begun, or even thought of, in many quarters—in this country at least; but it was due to the economic situation, just in the same way as is the war bonus. On behalf of the applicant, it was stated that he had been receiving, for doing light work, the same amount as was paid him before the accident in 1909; but it was felt by his advisers that he ought to have the benefit of the all-round increase of wages, owing to the increased cost of living, which resulted from an agitation in 1913 throughout the country by a number of trade unions. The Judge, however, while remarking that the facts were hard upon the man, said his case was hopeless. The circumstances put forward were not contemplated as a ground for increased compensation.

Germany's Gas Supply under War Conditions.

The "Journal für Gasbeleuchtung" of the 1st inst. reports that, according to statistics collected by the Central Gas Publicity Bureau of Germany, the gas produced in 726 German gas-works in January last showed a decrease of 7·5 per cent., as compared with the production in the same works in January last year. The decreases in the preceding months since the outbreak of war were given in the "JOURNAL" for April 27, p. 204. The Bureau, it appears, addressed a communication to the Ministry of the Interior and the Prussian Minister of War on March 24 last, pointing out that many of the smaller gas-works of Germany were placed in great difficulties in regard to carrying on their work, owing to the absence of the managers on military duties at a time when the rest of the skilled employees also had been more or less completely called to the Colours. It was suggested that the managers of smaller gas-works should be liberated from their military service. In a reply, dated April 24, the Ministry of War states that the Department cannot, on military grounds, accede to the request for a general liberation of managers of small gas-works from military service. The reply states further, however, that where it has been found impossible to replace the managers by others exempt from military service, special application should be made, giving details of the particular case, and evidence that such replacement has been found impossible. The applications will, it is promised, be considered as favourably as possible, having regard to the military interests involved.

DEATH OF MRS. JOHN YOUNG.

SINCERE sympathy will be felt throughout the profession with Mr. John Young, the Engineer of the Hull Station of the British Gaslight Company, in the loss that he has sustained through the death of his wife, which occurred very suddenly last Friday morning, at Claremont House, Beverley Road, Hull. Mrs. Young, who had recently undergone an operation, from which, however, there was every hope of her recovery, passed away very quietly. The funeral was yesterday.

The event is particularly sad, coming, as it does, just before the arrival of the time for Mr. Young to take up the presidency of the Institution of Gas Engineers. Mrs. Young was a popular visitor at the annual meetings of the Institution; and at the social events and on the excursions she was always a very welcomed participant.

PERSONAL.

Mr. M. F. FOGARTY, the Manager of the Lismore Gas-Works, has been presented with a handsome dressing-case by friends in the Young Men's Society of the town, on his leaving to take charge of the Rathfriland (co. Down) Gas-Works.

Mr. JAMES BERESFORD, Manager of the Ochiltree Gas-Works, has been appointed Manager to the Lochmaben Gas Company. He has held his present position nearly two years, during which time he has carried out important alterations to the works.

OBITUARY.

The death occurred on the 5th inst. of Mr. CHARLES JOHN BLAGG, the Chairman of the Cheadle Gas Company and of the Board of Guardians. He was in his eighty-third year. The funeral took place on Monday last week, and was attended by a large and representative gathering.

The "Journal für Gasbeleuchtung" of the 1st inst. reported the death, in action, of Herr GERHARD OTTO, the Manager of the Corporation Light and Water Works at Greisswald. Deceased, who was 35 years of age, had held the appointment since 1910. It was also reported that Herr ERICH SCHERHAG, the Manager of the Corporation Gas and Water Works at Eupen, was wounded in battle on Feb. 18, and taken prisoner by the French.

After about eighteen months' enfeebled health, Mr. THOMAS BUCKLEY, Chief Engineer at the water-works of the Canterbury Gas and Water Company, died on the evening of the 9th inst. He had been in the service of the Company for forty years, having been engaged in 1875 as Second Engineer, and being promoted to the higher position the following year. In accordance with his plans, and under his supervision, the works and plant were practically doubled. A good proof of the soundness of the schemes which he at various times submitted to the Directors has been evidenced in recent months by the ability of the water-works to sustain the enormous extra demand for water—amounting on some occasions to as much as 50 per cent. on the normal output—due to the large number of troops in the district. At their meeting on Monday last week, the Directors passed a resolution expressing their regret at the decease of Mr. Buckley, and recording their great appreciation of his untiring energy and zeal while in the Company's service. They also conveyed to the widow and family their sincere sympathy and condolence.

French for British Soldiers.—The welcome accorded to a pamphlet of "French for British Soldiers," issued with the "Co-Partners' Magazine" of the Gas Light and Coke Company, has induced Mr. Edward G. Phillips, of the Store Department of the Company, Horseferry Road, S.W., to re-publish the matter in the convenient form of a pocket-size booklet, with the addition of a military dictionary. Those who apply for samples will find this a helpful little companion for men proceeding to the front; and as the price is but a penny, there is no excuse for anybody being without a copy. Even those to whom the glory is denied of fighting for their country should find the military dictionary useful when studying the war.

Southern District Association of Gas Engineers and Managers.—The Association will visit Cambridge (the home of their President, Mr. J. W. Auchterlonie) for their spring meeting on Wednesday, the 26th inst. [The usual day for the Association meetings is Thursday; but Wednesday was the only day convenient to the Directors of the Cambridge Gas Company.] The members are invited to luncheon and tea by the Directors of the Company; and in addition to inspecting the gas-works, the visitors will have an opportunity during the afternoon of walking through some of the colleges. Such meetings as this which we now announce afford valuable opportunities for those responsible for public supplies to discuss matters with their professional brethren; and, at times like the present, when difficulties are being encountered in all directions, many valuable hints for the public welfare are disseminated.

INSTITUTION OF GAS ENGINEERS.

Programme of the Annual Meeting.

THE programme of the annual meeting of the Institution, which, as already announced, will be held on the 1st prox., has been issued. The members will assemble at the Institution of Civil Engineers at half-past ten, under the presidency of Mr. John Bond, of Southport. The first business will, as usual, consist of the submission of the minutes of the last annual general meeting, and the appointment of scrutineers for the examination of the ballot lists. The medals awarded for last year's papers [see *ante*, p. 255] will then be presented, and this will be followed by an address by the President. The remaining items on the programme consis of the presentation of the Council's annual report [see p. 383] and the statement of accounts, the report of the Refractory Materials Research Committee, by the Chairman (Dr. Harold G. Colman), the second report of the Ventilation Research Committee, by the Research Chemist (Mr. W. Harrison, M.Sc.), and the report of the Scrutineers on the result of the election of President and Vice-President for the ensuing year, and of the proposed members and associate members. The President of the Société Technique du Gaz en France will be proposed as an honorary member of the Institution, and the place of meeting next year will be fixed. At the close of the business outlined above, the annual general meeting of the donors and subscribers to the Benevolent Fund will be held.

ELECTRICITY SUPPLY MEMORANDA.

ALL over the country, the price of electric current is being advanced. The conductors of electricity concerns can no more help themselves in this matter than can the directors of gas undertakings. The purchasing power of their money, as in the case of other people, is less than it was preceding the war; and it is possible that this will be the condition, perhaps not to such a large extent, for a long period following the war. The electricity industry only consumes about one-eighth to one-tenth part of the total coal required by the gas industry. It is perhaps fortunate in this respect at the present time; but still what it has to buy, combined with the advance in the cost of other materials, labour, &c., means a considerable addition to its outgoings. On coal alone the Edinburgh Electricity Committee estimate that £10,000 additional will have to be spent by them this year. In proposing certain increases in the price of current at West Ham, the Electrical Engineer (Mr. J. W. Beauchamp) states that since nine years ago, when the flat-rate for lighting was reduced from 4d. to 3d. per unit, the price of coal has increased from 10s. to 15s. per ton, and the cost of labour has risen approximately 15 per cent. These are considerable additions to the costs; and Mr. Beauchamp has no alternative now but to suggest the raising of the price of current by ½d. (from 3d. to 3½d.) per unit for lighting or 16⅔ per cent., and for power and heating to 1½d. per unit, or 12½ per cent. Several undertakings (both in London and the Provinces) have already put up their charges 10 per cent. The Metropolitan Electricity Supply Company are among the number; and the Acton Chamber of Commerce think the Company are dealing very harshly with the local tradesmen, and ought to cut down the addition by one-half. The Kingston-on-Thames Electricity Committee (who recently increased the prices for other purposes), thinking that the users of current for heating, cooking, and power would like a little arithmetical exercise during these unexciting times, have raised their price for these purposes to 1$\frac{1}{20}$d. per unit. The fraction will certainly add to the amenities of the consumers. The Manchester Corporation Electricity Committee, with the benevolent intention of providing £30,000 for the relief of the rates, have proposed an addition of 10 per cent. to the accounts for lighting units, 15 per cent. to those for industrial power, and 10 per cent. to other domestic charges. Consumers paying on the assessment system are to have the lump-sum payment raised from 12½ per cent. to 15 per cent. of the rateable value—the secondary charge of ½d. per unit remaining. The advance will not apply to 75 per cent. of the department's volume of business, seeing that the large consumers are charged under a sliding-scale according to the prices of coal and other materials. Gas and electricity consumers have their own additional burdens to bear due to the war; and it is a gross imposition upon them that the price of gas or electricity should be raised for the sole purpose of lightening the rates over the whole of the ratepaying part of the population. Some of the smallest gas and electricity consumers benefit most largely by the system of rate-aid from the trading undertakings; and the largest consumers of either commodity are supplied at very reasonable rates.

Upward Bound.

Divergent Cooking Costs.

"Electrical Industries" has been publishing some cost figures for four electric-cookers in use at Hampstead; and it says that the figures dispose of the notion held in certain quarters that electric cooking is a wildly extravagant proposition. The basis for this statement appears to be a very insecure one; for the writer does not seem to be in possession of any factors affecting cooking costs to apply to these cases. If he has

he does not disclose them. The principal factor, of course, is the quantity of work done; and there is no indication as to whether, for the work performed, the outlay for current is, or is not, expensive. Anyway, it seems that the current used for cooking is only charged out at ¾d. per unit. What the figures do show is the utter absurdity of our electrical friends trying to standardize the average cost of current for cooking per head per day. No two houses are alike in respect of the quantity of cooking that is done in them; and the requirements of families in regard to food, &c., differ considerably. In one case, with four persons in family, the electricity bill only comes to £3 7s. per annum; while in another case, with the same number of persons in family, the amount of the account is £8 17s. a year, or £5 10s. more. In one instance, with five persons in family, the cost comes to £4 17s. a year; while in a further case of five persons the cost is £7 16s. 3d. per annum, or £2 19s. 3d. more. Our contemporary concludes either that cooks are very variable quantities or else that the amount of cooking required in the several households cannot be calculated from the number of persons involved. We think that he is safe in the latter assumption, and that electrical engineers have been rather foolish in respect of their worship of averages. Just apply a little common sense to the figures. Is it possible that all the cooking—baking, boiling, and grilling, including hot water for washing up—can be done by electricity, having a calorific value of 3420 B.Th.U. per unit, for a family of four, from the first meal to the last in the day, for anything like £3 7s. per annum, even with electricity sold at ¾d. per unit? What does this mean? A cost of only 0·55d. per person per day, or 0·73 unit of electricity. The £8 17s. per annum only means 1·45d. per person per day, or 1·94 units of electricity. Think of the figures, and then of what has recently been said in the discussion of Mr. Cooper's paper about the inefficiency of electric hot-plates, together with the acknowledgment that something like 70 per cent. of the cooking work for a household is done outside the oven. Is it true that all the cooking for a family of four is done for anything like £3 7s. per annum by electricity? Absurdity and pretence go well together in electrical harness.

Ventilation. The problem of ventilation where there is electrical operation appears to have hitherto had only one solution, and that is the electric-fan. Save for the buzzing noise, the overheating, breakdowns, and other incidental annoyances, the electric-fan does assist in the summer to keep the air in motion, and so adds to healthful conditions; but now one well-known firm are advertising "Freezor" electric-fans for summer use. "Freezor" is not a nice name. It suggests winter conditions in summer, and awful colds by exposing the body to extremes in temperature. But the difficulties of ventilation are for electrical people increased in the winter where electric heating and electric-fans are companions. Fans that produce freezing conditions are not required in rooms in winter; and the electric "fire" has no sufficient capacity, unless of large size and with a large appetite for current, to counteract the pull of an electric-fan upon the air of a room, and the electric-fire does not, and cannot, promote any sufficient ventilation of its own accord, such as is the case with fires produced by the combustion of solid or gaseous fuel. The result is a choice between the electric-fan, with a loss of temperature (which can be ill-afforded), and stagnant conditions of the atmosphere. This has manifestly dawned upon the writer of "Cooking and Heating Notes" in the "Electrical Times;" for he states that, with the growing use of electric heating, there is undoubtedly a demand for a form of convector that can be housed near a fan within the ventilating duct close to the intake. The question of high temperature comes in here. There is a danger; and there is also the trouble (which he does not mention) that the heating of air by convection should be done at low temperatures and not at high. However, on the point of danger, the writer thinks that heavier loadings for a given length and size of resistance wire are possible in such circumstances than would be permissible with a heater operating in the open air; for the rapid passage of air through the heating coils from the fan blades would, "of course, keep down the temperature within limits." If air super-baked in this way is the brand that the electrical writer proposes to deliver to a room, then the occupants would deserve the sympathy of their more thoughtful friends. But he admits possible troubles from the risk of breakdown of the heating units, due to the stoppage of the fan, or to running it at speeds insufficient to prevent a dangerous rise in temperature. But though he fancies it ought to be a simple matter to provide against these troubles, it has not been demonstrated by actual experience that the idea would be effectual. However, there comes a little surprise towards the end of the article. Gas people have been jeered at by some (on the subject of ventilation) empty-headed electrical critics for claiming that the heat of gas on combustion gives rise to upward currents and renders assistance in drawing air into a room; and that, given the simplest of outlets at the upper part of the room, this action of the gas-burner provides an inexpensive and efficient means of ventilation. Now, if there is any meaning to be attached to the following statement, this writer in the "Electrical Times" in effect grants that there is truth in the contention of the gas people. He says:

> With a small ventilating system, in places where the conditions are not severe, and only a steady replacement of the air is required, it is possible to dispense with the fan. In this case more or less standard heating elements can be fitted near the outlets of the duct system; and these, by heating the air above them, cause a current of cool air to be drawn through the pipes from the inlets placed outside the building; the warm air being discharged somewhat above the floor-level.

"Above the floor-level" is a little bit loose, and leaves some doubt as to what the writer has in mind regarding the point of ejection. But from a special heating element the heat will not be great; and how much better, therefore, can a gas-burner play the part, with the draw upon the air and the creation of upward warm currents—at the same time providing an efficient system of illumination in the room. This is about the first time within recollection that there has been any electrical admission as to the well-known ability of heat to promote ventilation. But the electrical method proposed is only toying with a question which is really of the utmost importance in the promotion of healthful conditions in the home.

Warfare and Gas and Electricity Supply. Some time ago, we pointed out how opportunely the breakdown and fire at the Greenwich power station came when London tram-cars were brought to an abrupt standstill, and London workers were caused a large amount of inconvenience—that is to say, opportunely as producing excellent evidence in respect of the unwisdom of the London County Council's scheme for big concentrations of electricity generating plant for London, and the abolition of the smaller separate stations. Mr. W. H. Booth, writing in the "Electrical Times," thinks so too; and he admits that an electrical breakdown does not announce its imminence. "It just happens like the bursting of a great shell, and no man knows when the happening is to take place." Truth blossoms out at times in our electrical contemporaries. Mr. Booth is of opinion that the Greenwich catastrophe will now induce thoughts more to decentralization than to centralization. The war, too, has had its lessons; and "no thinking man can longer regard as good policy the undue centralization of the necessaries and conveniences of a great city. Great power stations in particular are disadvantageous, presenting as they do such easy marks to an ambitious airman." What caused the immense collapse and disorganization at Greenwich? Merely the breakdown of an oil transformer, and presumably the letting loose of all the power of the station into this little space filled with oil. The great breakdowns and fires in electricity stations have had very small beginnings; and one shudders to think what destruction a well-directed bomb would produce in the midst of a large centralization of electric plant. Mr. Booth, on the other hand, acknowledges that great disaster to a gas plant need not follow an attack from the air. This has been proved in the present war—both in connection with aerial and with sea bombardments. The reason is that the manufacturing plant of a gas-works is constituted of comparatively small units, which can be isolated. If two or three retort-settings get shattered, continuity of work is only a question of valvular isolation from the remainder. In Northern France, one gas-works had a bomb through the roof of the retort-house. There was loss of life, and plant was damaged. But the gas supply continued unaffected. Hartlepool had one or two of its gasholders "potted," and put out of action; but the people of the town suffered little inconvenience.

Glassware for Colour Matching. It is stated that the British Thomson-Houston Company are putting on the market a range of colour-matching globes, which (used with electric-lamps) will, it is said, ensure artificial light of daylight value. The name "Trutint" has been given to this glassware; and it is said to be available in various compositions to ensure different sunlight values. The globes have been specially made for "Mazda" half-watt lamps, which are said to be, owing to their high intrinsic brilliancy, more like sunlight in colour than the earlier types of incandescent lamps. The watts per candle efficiency of "Mazda" half-watt lamps, when fitted with the new type of globe are said to be practically equivalent to standard Mazda lamps in white opal globes. Opal glass may, according to its density, absorb anything between 25 and 60 per cent. of the light developed by the enclosed lamp, so that one is left in uncertainty as to the efficiency of lamps encased in these special "daylight" producing globes. However what we do wonder is whether the globes can be used with incandescent gas-burners. If not, why not?

Otto Coke-Ovens on Tyneside.—The current number of the "Engineer" contains an illustrated description of an installation of 120 coke-ovens, with complete bye-product recovery plant, which has lately been brought into use at Teams, near Gateshead. It is stated that this is the first installation in Great Britain which can be termed "independent"—that is to say, not established to work in conjunction with any particular colliery or group of collieries or any of the steel or iron works. The project is that of the Teams Bye-Product Coke Company, Limited, which was incorporated about three years ago with a share capital of £200,000, and in which a number of northern coalowners are associated. The whole of the installation has been designed and erected by the Otto Coke-Oven Company, Limited, of Leeds, to the general requirements of Mr. Ernest Bury, of Skinningrove, Yorks, the Consulting Engineer of the Teams Company, Limited. The coal washing, handling, and crushing plant was manufactured and erected by Messrs. Campbell, Binnie, Reid, and Co., of Burnbank, to the specification of the Otto Coke-Oven Company.

INSTITUTION OF GAS ENGINEERS.

Annual Report of the Council.

In opening their report for the year ending this month, the Council of the Institution of Gas Engineers first make reference to the war in which our country and her allies are engaged, and the determination of the British gas industry to continue to do all within its power to aid them. They remarked that in the *personnel* of both Navy and Army the gas industry is proud to be identified; for there are a large number of officers and men who are serving with the Colours. During the year, the Council have been taking up various questions and difficulties which have arisen, including the shortage of coal supplies, tar production and disposal in relation to the dye industry, and regulations for the recruiting of employees.

The total membership of the Institution for the year ended December, 1914, was 881, compared with 875 the previous year. The additions to the register consisted of three honorary members, thirty-one members, and ten associate members.

The Council regret to record the deceases of the following: Honorary Members: R. Forbes Carpenter, London; Philibert Delahaye, Paris. Members: William Blair, Helensburgh; Thomas James Bush, Sydney, N.S.W.; James T. Byrom, Corbridge; John Carter, Lincoln; John Chew, Blackpool; Adam Cooke, Oldbury; William Davis, Poole; Richard Henry Dyer, London; William Fergusson, Barrow-in-Furness; Thomas Guyatt, London; William Langford, Stoke-on-Trent; Joseph Morris, Jersey; Thomas Newbigging, Manchester; Gordon Walker, Wantage. Associate Member: William Henry Owen, Hornsey.

Meeting in Liverpool.

The fifty-first annual general meeting of the Institution took place in Liverpool from June 16 to 18, under the presidency of Mr. Edward Allen, the Engineer to the Liverpool Gas Company. After giving a list of the communications considered at the meeting, and referring to the social functions, the Council state that they have made the following awards for papers read: The London Gold Medal to Mr. George T. Purves, for his paper on the "Application of Coke-Oven Carbonizing and 'Otto' Direct Ammonia Recovery to Gas-Works Requirements;" the Institution Gold Medal to Mr. Jacques Abady, for his paper on "Calorific Power as a Standard;" the Silver Medal to Mr. John West, for his paper on "Lime and Sulphate of Ammonia as Fertilizers, and how to Increase their Sale;" and the Bronze Medal to Mr. B. K. Schieldrop, for his paper on "Some Special Features in Gas-Works Practice from Norway."

Examinations in Gas Engineering, Supply, and Fitting.

Mr. Samuel Glover, the Examiner in "Gas Engineering" for the City and Guilds of London Institute Examinations, reports that at the examinations which were held on April 24 last 166 candidates presented themselves, of whom 68 sat for the Final Paper and 98 for Grade I., compared with 295 for the previous year, consisting of 125 in the Final and 170 in Grade I.

Mr. Walter Hole, the Examiner in the subject of "Gas Supply," reports that 343 candidates presented themselves for examination on May 1—163 in the Final and 180 in Grade I. In the previous year the number of candidates was 671, made up of 225 in the Final and 446 in Grade I.

Messrs. H. Kendrick and R. Halkett, the Examiners in "Gas Fitting," report that 257 candidates presented themselves for examination—consisting of 48 in the Final, 76 in Grade II., and 133 in Grade I.

The prizes offered by the City and Guilds of London Institute and the Goldsmiths' Company in connection with the examinations of 1914 were awarded as follows: In "Gas Engineering," Final Grade, first prize and a silver medal to Tom Rudge, of Stafford; Grade I., first prize and a bronze medal to Walter Alfred Barnett, of London, second prize and a bronze medal to Ernest W. Muddiman and Leonard H. Thomas, both of Birmingham; third prize, a bronze medal, to Clifford Duncan, of Hull.

In "Gas Supply" final, the first prize and a silver medal was awarded to Tom Rudge, of Stafford; in Grade I. the first prize and a bronze medal to Horace Gordon Beesley, of Birmingham; the second prize and a bronze medal to Alexander Low Edwards, of Liverpool; and the third prize, a bronze medal, to James E. Pratt, of Liverpool.

The special prizes offered by the Society of British Gas Industries were awarded: In "Gas Engineering," first prize to Tom Rudge, of Stafford; second prize to John William Jones, of Hadfield. In "Gas Supply," first prize to Tom Rudge, of Stafford; second prize to James Lawrence Page, of London.

The Council have approved of a scheme for the issue of an Institution certificate to gas-fitters over 35 years of age, who for various reasons may not desire to sit for the City and Guilds of London Institute examinations. The issue of these certificates will take place during a period of two years from the date of the announcement of the regulations.

In approving this scheme, the Council desire to point out that it is intended to serve as an interim arrangement only, in order to meet special conditions. It is hoped therefore that as many candidates as possible will enter for the examinations of the City and Guilds of London Institute, for which there is no age limit. The Council are anxious that these examinations, in the arrangement of which the Institution has taken such an active part, shall be successful in every way throughout the whole country.

Refractory Materials Research Committee.

The Refractory Materials Research Committee, consisting of the President, Vice-Presidents, and Hon. Secretary *ex-officio*; and Messrs. H. G. Colman (Chairman), J. Ferguson Bell. John W. Cobb, J. A. Harker, J. P. Leather, W. S. Morland, W. B. Randall, S. Y. Shoubridge, Alex. Wilson, H. W. Woodall, and F. J. Bywater (Hon. Secretary of the Committee), report that their work has been much interfered with during the past year by causes arising out of the war. The Hon. Secretary (Captain F. J. Bywater) and Major H. W. Woodall are both away on active service. It has only been possible within the last few weeks to obtain delivery of the necessary apparatus for carrying out the investigations arranged for the current year. Now that the apparatus is installed, Dr. J. W. Mellor is proceeding with the experiments on the effect of high temperatures on fire-clays and refractory materials under load, and, in addition, investigation will be made of the cement material employed for jointing in retort-settings, and of the difference in size of whole bricks from different sources when cold and when at high temperature.

Ventilation Research Committee.

The Joint Committee on Ventilation Research, consisting of Professors Arthur Smithells (Chairman), John W. Cobb, J. B. Cohen, and Mr. R. G. Thompson, representing the University, and Messrs. John Bond, J. H. Brearley, E. W. Smith, and Charles Wood, representing the Institution, have continued their work during the year, and their second report is to be submitted at the annual meeting of the Institution. Mr. Wm. Harrison has acted as Research Chemist under the direction of Professor Cobb.

Institution Gas Research Fellowship.

Mr. Harold Hollings, having been awarded a scholarship by the Royal Commissioners of the Exhibition of 1851, resigned the Institution Gas Research Fellowship which he was holding. In the special circumstances of the war, it has been decided by the Senate of Leeds University, with the concurrence of the Council of the Institution, not to appoint a successor at present.

Corbet Woodall Scholarship.

It was announced at the meeting of the Institution at Liverpool that Sir Corbet Woodall was desirous of endowing a Scholarship in Gas Engineering of the value of £50 per annum to commemorate the celebration of the Institution's Jubilee in 1913.

The Council, in gratefully accepting the gift on behalf of the Institution, obtained the consent of the donor to name it "The Corbet Woodall Scholarship." It has been made tenable at Leeds University, the Senate of which has appointed the Vice-Chancellor (Dr. M. E. Sadler) and Professors John W. Cobb, J. B. Cohen, John Goodman, and Arthur Smithells to act in consultation with the following Committee appointed by the Council of the Institution, Messrs. Edward Allen, Charles Carpenter, W. T. Dunn, J. G. Newbigging, and Henry Woodall, jun., with the President, Mr. John Bond, and the Hon. Secretary, Mr. W. E. Price, *ex officio*. This Committee will submit to the Senate recommendations for award.

The following is a copy of the conditions under which the scholarship will be awarded:—

The Institution of Gas Engineers have established a scholarship bearing the name of Sir Corbet Woodall and tenable at the University of Leeds, of the annual value of £50 for three years, with power of extension for a fourth year on the recommendation of the Senate to the "Corbet Woodall Scholarship Committee." The continuation of the scholarship each year after the first will depend on the work done by the scholar in the previous year being reported to the Committee as satisfactory.

The scholarship is intended to enable a student to take a course of study in gas engineering at the University in preparation for a responsible position as a gas engineer. Candidates for the election to the scholarship are required

(1) To produce evidence of having reached a standard of scientific or technological education sufficient to enable them to take advantage of the B.Sc. degree or diploma course in gas engineering, and

(2) To give an undertaking of their intention to follow the profession of gas engineer.

On each vacancy the award of the scholarship will be made ordinarily during the month of June, after due advertisement in the Technical Press. The scholarship will be awarded by the Senate after consultation with the "Corbet Woodall Scholarship Committee."

Each candidate is required to submit

(1) A statement of his previous education and of his scientific or technological qualifications.

(2) Testimonials
(*a*) From the head of the Institute in which he received his previous education.
(*b*) If he has been already engaged in gas engineering works, from the engineer of the works.

The Senate, in conjunction with the "Corbet Woodall Scholarship Committee," will determine what examination, if any, is necessary in order to guide them in the award of the scholarship.

Standard Specification of Street Lighting.

Mr. Robert Watson reports that one meeting of the Joint Committee dealing with the preparation of a Standard Specification of Street Lighting has been held, for the purpose of considering alternative clauses to those covering the appraisement in horizontal plane foot candles of minimum street illumination.

Mr. F. W. Goodenough submitted his promised proposals, which were to amend the "Unit of Measurement" clause, in the draft specification, by the substitution of the "candle power of lamps" for "minimum illumination expressed in foot candles." The candle power was to be determined by direct readings at specified angles, and "with a specified relationship between readings at the widest and narrowest angles." The suggestion also included a classification of streets in terms of aggregate candle power per content of thoroughfare.

The candle power proposals were generally discussed by the Committee, but on a vote were not accepted by the majority.

A resolution was subsequently passed for the adoption of the specification as originally drafted, but with the two following modifications—viz.: (1) That the maximum as well as the minimum horizontal plane illumination should be stated, the one being within definite limits of ratio to the other, and (2) that clause 8 should be worded so as to allow of some specified control as to height of column. The details of the modifications are to be discussed at a future meeting.

International Commission on Illumination.

The work done by this Committee during the year 1914 has been summarized in the report which the Chairman (Mr. Edward Allen, of Liverpool) presented at the special annual meeting of the Committee held on Jan. 12 last. This report was given in the "Journal" for Feb. 9 [p. 326].

In addition to continuing the work referred to in the Chairman's report, the Committee has secured the collaboration of the National Physical Laboratory and a number of other physical laboratories in carrying out investigations to determine the height of the amyl-acetate flame which affords a light of one standard candle.

International Commission on Pipe-Threads.

Mr. Alex. Wilson, the Institution's representative on this Commission, reports that the British and German delegates met in Paris to adjust certain outstanding differences, shortly before the meeting of the Sous-Commission to which all the details of the threads, &c., were referred. A meeting of the Sous-Commission was held in Paris from July 20 to 22, 1914, when the details referred to them by the International Commission were discussed and settled. It was arranged that the delegates should check the figures then arrived at with a view to a final meeting of the Sous-Commission being held in Paris in the following November. Owing to the outbreak of war this meeting has not yet been held.

Gauging of Gasholder Sheets.

At the request of the Society of British Gas Industries the Council have considered proposals for the adoption of a common method for gauging gasholder sheets, and have agreed to the following:—

1. That the recommendations of the Engineering Standards Committee be recognized.
2. That the standard wire gauge be employed (S.W.G.).
3. With regard to sheets $\frac{1}{4}$ inch thick and under, where a thickness or weight is specified, there shall be a rolling margin in the thickness or weight of 5 per cent. under and over.
4. With regard to plates and sections over $\frac{1}{4}$ inch thick, the recommendations of the Engineering Standards Committee shall apply.
5. That engineers who provide quantities shall make the aforementioned allowances of 5 per cent. on sheets and $2\frac{1}{2}$ per cent. on plates in all cases where they require sheets or plates to gauge the full thickness on the longitudinal edge.

Life of Gas-Meters Inquiry.

A Joint Committee of the Institution and the Society of British Gas Industries has been appointed to investigate the various conditions affecting the life of gas-meters. The Committee consists of Messrs. Edward Allen, John Bond, A. E. Broadberry, Samuel Glover, Robt. G. Shadbolt, W. E. Price, Sir Corbet Woodall, and John Young representing the Institution; and Messrs. T. A. Braddock, J. W. Broadhead, F. G. Cockey, F. Templer Depree, J. William Glover, Thomas Glover, Joseph Hepworth, and W. H. Johnston representing the Society. Dr. Rudolf Lessing has been appointed Chemist to the Committee, and the inquiry is now being proceeded with.

National Insurance Act (Part II.) Unemployment.

On behalf of the Committee entrusted with this matter, Mr. Alexander Wilson reports that very few decisions affecting the gas industry have been issued by the Umpire since their last report. Nothing of an important nature has been dealt with; and very few inquiries have been received during the year regarding the working of the Act.

Parliamentary Committee.

During the year various matters which the Committee have had under their attention have been proceeded with, and satisfactory results obtained.

Canal Traffic.

The Waterways Association continue to receive the support of the Institution. The programme of the Association is to induce the Government to give effect to the report of the Royal Commission on Canals by the State acquisition of the main waterways of the country and their development in co-operation with local authorities. The Council refer to the report of the Association for the year 1914, some points from which were noticed in an article which appeared on p. 13 of the "Journal" for April 6.

International Engineering Congress.

In connection with this Congress, to take place at San Francisco in September next (which the members of the Institution have been cordially invited to attend), an International Gas Congress is to be held. Mr. Edward Allen has kindly consented to represent the Institution on that occasion, and to be responsible for obtaining papers dealing with British gas engineering practice for presentation to the Congress.

Government Aid to Statutory Gas Undertakings.

The question of Government financial aid to statutory gas undertakings requiring means for carrying out pressing works' extension was considered by a Joint Committee of the Institution, the Society of British Gas Industries, and the British Commercial Gas Association. The President interviewed a representative of the Board of Trade on the subject; and a communication was subsequently received stating that the Board were unable to hold out any expectation of assistance being granted.

Tar Prices and the War Crisis.

To consider the effect of the war crisis on prices for tar, joint meetings of tar producers and tar distillers have been held, and proposals put forward with a view to arriving at arrangements which would be acceptable to both parties. Conditions for deliveries of, and payments for, tar were drawn up and circulated to gas undertakings and tar distillers, but had to be withdrawn owing to the failure of efforts to fix the minimum price of pitch. Tar producers were, therefore, recommended to make their own arrangements for their tar contracts.

Tar Products Inquiry.

The President was requested to assist the Board of Trade Committee appointed to consider the best means of obtaining for the use of British industries sufficient supplies of chemical products and colour and dyestuffs, a great proportion of which has hitherto been imported from Germany. A set of questions was issued to all gas undertakings in the United Kingdom, and the information obtained was communicated to the authorities.

Coal Supplies.

The Council have for some time had under observation, and have been taking active steps in regard to, coal supplies. A number of communications on the subject have passed between the Institution and various Government Departments. An interview took place with Mr. Runciman (the President of the Board of Trade), who stated that the Board realized the seriousness of the matter, and would do all within their power to overcome the difficulties which had been pointed out. Matters became so grave, owing to continued depletion of stocks, difficulties of obtaining supplies by rail and sea, and the abnormal increase in freights, that the Institution joined in a national conference of gas and electrical interests which was held on May 6 for the purpose of considering the best course to adopt for bringing the far-reaching issues of the situation under the immediate attention of the Government. [A report of the proceedings at the conference appeared on pp. 325 9 of last week's "Journal."]

(Signed) John Bond, *President.*
Walter T. Dunn, *Secretary.*

May 11, 1915.

BENEVOLENT FUND COMMITTEE'S REPORT.

The Committee of Management of the Benevolent Fund of the Institution, in their report for the past year, state that during the period covered grants were made in relief of seventeen necessitous cases, all of which received the fullest possible consideration. There are now sixteen names on the list of recipients of grants.

The accounts show that the income for the year ended Dec. 31, 1914, was £387 15s., being £224 7s. 9d. from subscriptions, £46 from donations, £106 7s. 9d. from interest on investments, £1 1s. 11d. from interest on deposit at bank, and £9 17s. 7d. from refund of income-tax. The expenditure of £395 10s. 8½d. was made up of £364 8s. for grants to widows, orphans, and members, £20 1s. printing and stationery, £4 19s. 5½d. postages, receipt stamps, &c., £2 1s. 1d. bank charges, and £4 1s. 2d. for legal expenses consequent on the appointment of a Trustee.

The Committee regret to record the death of Mr. Thomas Newbigging, D.Sc., the Senior Trustee to the fund, who had

always taken a great interest in its work. The gift of fifty guineas which he made on the occasion of the Institution's Jubilee in 1913 will be gratefully remembered. A meeting of contributors was held on Oct. 26 for the purpose of appointing a successor, when Mr. C. Carpenter, D.Sc., was unanimously elected.

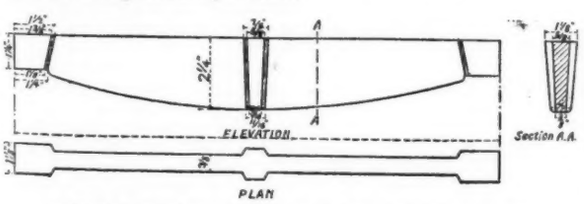
Having regard to the deficit shown in the annual accounts, and to the necessity for providing for new applications for relief, it was decided at the above meeting to issue a special appeal to non-contributing members of the Institution. In response to this the amount of £35 5s. 6d. has been received in annual subscriptions, and £25 15s. 6d. in donations. There is still need, however, the Committee say, for a further increase in income; and every contributor is urged to assist in obtaining this, by reconsidering the amount of his own annual subscription and by obtaining new subscribers.

At the forthcoming annual general meeting, Mr. Edward Allen and Mr. C. Dru Drury retire from the Committee by rotation. To serve in their places, the Committee nominate Mr. Samuel Glover, of St. Helens, and Mr. H. E. Bloor, of York.

COKE v. WELSH COAL FOR STEAM-RAISING.

In previous issues of the "Journal" attention has been directed to the work of the London Coke Committee in making known the advantages of gas coke as compared with Welsh coal for raising steam. It may be remembered that the National Steam-Car Company carried out a series of trials of coke as fuel for driving their omnibuses; and the Royal Automobile Club regarded them as so meritorious that they awarded the Company the Dewar Trophy. Evidence is to hand that the Committee are continuing their propaganda with activity, with the able co-operation of Mr. E. W. L. Nicol, their Engineer and Technical Adviser, who, in a recent number of "The Commercial Motor," wrote about "Cheap Steam." The editor of the publication named had advocated the training of drivers by the makers of steam-vehicles; and Mr. Nicol suggested that the training might with advantage be extended to the owners and prospective owners of these vehicles. He pointed out that in preaching "steam" for loads exceeding 2½ tons, the editor and the makers were recommending motor-vehicles of relatively high overall efficiency. Yet how few drivers and owners really appreciate the difference between "steam at any cost" and "cheap steam." Steam power generated on high-grade Admiralty Welsh coal is quite unnecessarily handicapped by comparatively high fuel costs. In the operations of steam-vehicles in towns, smokeless combustion is a *sine quâ non;* and this consideration confines the range of suitable solid fuels to the various grades of Welsh coal and gas coke. Fire-grates designed with narrow and limited air spaces, to burn more or less friable Welsh coal without undue waste, are usually unsuitable for burning coke; and to impose the latter fuel on a driver without first investigating firebox and draught conditions, usually leads to disappointment in results, and probable prejudice to the unfortunate man who is made responsible for failing to obtain improved working under conditions quite unsuitable for the attainment of such success.

Mr. Nicol states that various boiler-makers have shown, during official tests, that suitably-graded gas coke will evaporate upwards of 10 lbs. of water from and at 212° Fahr. per pound of coke as fired. With the best Welsh coal this figure may be exceeded by 8 or 10 per cent. under favourable conditions; but the difference in cost of the two fuels varies between 25 per cent. in the London district to 50 per cent. or more in the Provinces. Taking advantage of these facts, a few of the leading makers invariably send out waggons properly equipped for burning coke, whereas others do so only by special request. Suitable firebars may, however, be fitted to any type of waggon without reference to the makers; and Mr. Nicol gives the following diagram of one specially applicable for cheap steaming on coke.



A Special Fire-Bar suitable for Cheap Steaming on Coke.

The illustration shows the type of firebar fitted to a five-ton "Foden," which is hauling its full maximum legal load—and sometimes a little more—on coke exclusively. No alteration to the side bars is necessary; while the complete equipment costs, Mr. Nicol states, less than a sovereign per set. A four-ton "Garrett" on a relatively low mileage—150 miles per week—averages less than 8 lbs. of coke per mile. For coke fuel, the firebars should be ½ to ⅝ inch thick, and the air spaces between the bars about ½ inch for five-ton waggons on steel tyres, which transmit vibration to the firebox. For waggons on rubber tyres, a minimum of ⅓ inch has been found desirable. Mr. Nicol says the heat expenditure per vehicle-mile will be about the same whatever kind of solid fuel is used. The main thing, however, is to "buy potential B.Th.U. in the cheapest market."

Necessarily efforts are being made by parties interested in Welsh coal to extend its use for raising steam, and depreciate coke as a fuel for this purpose. For example, we have before us a booklet in which it is asserted that Dowlais coal is considerably cleaner in use than coke, and that under similar running conditions twice the amount of the latter fuel is required to produce the same result. It is also stated that in country districts great difficulty is found, when using coke, in keeping a head of steam, and that the difficulty is intensified as the haul becomes heavier over stiff gradients. The representative of a certain coal company, writing recently in the "Journal of Commerce," stated that with coke a waggon has to stop at the foot of any stiff gradient to get a head of steam for climbing; and that it takes an hour and a half to get one for moving in the morning. For long-distance work, it meant, said the writer, that most of the waggon, which ought to be utilized for cargo, was taken up with coke for burning; while the present high price of this fuel put it entirely out of court, when compared with his Company's coal, to any commercial man whose steam-waggons must show economy per ton-mile. Given a standard machine with an efficient driver and the coal referred to, he was confident that a very large saving could be shown over either horse or petrol machines; but this could not be proved if commercial waggon users relied upon coke.

Appended to this letter was one by a writer who had contributed to a previous issue an article on the coke-fired waggon of the National Steam-Car Company. This gentleman considered that "good smokeless steam coal is a far better fuel, and is infinitely more economical to use, than either soft coals or coke." Referring to the National steam-waggon, he said he welcomed the development of this vehicle because of its clever design and the fact "that it is very little heavier for a given load capacity than is a petrol-waggon, and probably not much more than half the tare weight of a steam-waggon of normal design for similar loads." These special features, he said, enabled the National waggon to "travel very long journeys without stopping to pick up either fuel or water." He pointed out that this waggon had been specially designed and built with a view to using coke fuel, and he expressed the opinion that "probably coal could not be economically burnt in its firebox." The results obtained with the coal of the Company already referred to, used in three-ton waggons, show consumption at the rate of 5·6 lbs. of coal per mile travelled. The writer thought this was very good, taking into account the class of service; but he said it was not a record. As it is not always possible, when travelling about the country, for a driver to purchase good steam coal, he thought in such cases a mixture of steam coal and coke, or coke alone, might be used; but he should not consider its use would show any saving in the fuel cost or the total costs per vehicle-mile.

Against these views it will be well to put some particulars contained in a booklet on "The Fuel Problem," which is being issued by the Coke Committee. It has been prepared and illustrated to suit local conditions, and is being bought and distributed by waggon makers; but as the subject-matter applies to steam-raising by coke fuel, it is suitable for general use. It is shown that Welsh coal of 15,000 B.Th.U. per pound (an exceptionally good quality), at 30s. per ton, is equivalent to 93,300 B.Th.U. for 1d. On the other hand, graded gas coke, of 12,500 B.Th.U. per pound (as sold), at 20s. per ton, is equivalent to 116,625 B.Th.U. for 1d. Gas coke contains, therefore, 25 per cent. greater heat value at the above difference in cost. In his article in "The Commercial Motor," already referred to, Mr. Nicol gave the figures for graded gas coke at 18s. 4d. per ton as 125,000 B.Th.U. for 1d., compared with 95,000 B.Th.U. for 1d. with Welsh coal at 30s. per ton—an increase of 32½ per cent. The following figures in regard to the consumption of coke on steam-waggons in the first quarter of the present year may be interesting. With a four-ton waggon having rubber tyres the runs in the three months were 12·26, 11·7, and 14·36 miles per cwt.; while in the case of a five-ton steel-tyred waggon with a two-ton trailer they were 7·5, 7·7, and 6·5 miles per cwt. The question naturally arises as to why users of steam-waggons do not burn gas coke instead of soft coal. The answer in all probability is because the waggons have been provided with fire-grates having extremely limited air spaces, which are generally unsuitable for coke. Fire-grates for burning this fuel can, however, as already pointed out, be fitted to any type of steam-waggon at trifling cost. These will enable the users to realize the advantages of the cheapest motor fuel, and avoid the waste due to the accumulations of coal dust. Suitably graded gas coke (No. 2), broken ready for use in motor-vehicles, may now be obtained at the lowest current rates at any of the London or Suburban Gas Companies' works.

The booklet just noticed has been published by the Coke Committee with the view of securing to the gas industry a fair share of the growing and important business of fuel supply for motors by inducing all makers of steam-waggons to provide sufficient grate area and suitable grates for coke fuel, and prospective users to buy steam instead of petrol waggons, also to lead owners of waggons to insist upon having the cheapest possible suitable fuel. In the interests of the South Wales colliery owners, much money is being spent on advertising, in order to secure the very profitable source of business in question. The comparatively small endeavour of the Coke Committee in this direction, in advertising in motor publications, on coke-delivering waggons, &c., cannot fail to offset, in some measure, the efforts of the Welsh coal interests, and, being universal in its incidence, it is worthy of the support of the gas industry as a whole. The Editor of the

"Commercial Motor" estimates that at least 1200 steam-motors are at work in the London district. This number, which is being daily increased, represents a fuel consumption of from 800 to 1000 tons per week. Important makers like Leyland Motors (1914), Limited, and others, recommend the use of coke; while others, like Messrs. Alley and M'Lellan, offer to provide grates for Welsh coal or coke as desired. Certain makers cut down the grate area of the small locomotive type of boilers provided, with the idea that Welsh coal only will be used. The prospective owners should, however, have the final word in this matter, and should be induced to bring pressure to bear on designers, to provide a grate area that will ensure the maximum possible capacity of the waggon being realized on the cheapest smokeless fuel obtainable. The London Coke Committee, whose offices are at No. 84, Horseferry Road, Westminster, will advise steam-waggon owners in the London district on matters relating to fuel consumption.

It may not be without interest to close this article with some remarks made by Mr. Nicol in the course of the discussion on a paper on "The Production and Use of Steam in Breweries," read by Mr. Horace Boot, Past-President of the Institution of Municipal Engineers, at a recent meeting of the London Section of the Institute of Brewing.

Mr. Nicol said that direct economy in steam production naturally began with judicious selection and purchase of steam-raising fuel. In London the range of selection was more or less limited to smokeless or semi-smokeless fuels. Recently he had had occasion, in the interests of his employers, to ascertain what fuel values were being offered in London (at rates current before the war) in the way of steam coal and coke suitable for steam raising. The result of his experiments are given in the following table:

Competing Fuel.	Fixed Carbon.	Ash.	Hydrogen.	B.Th.U. per Pound Dry.	Cost per Ton in London.	B Th U. per 1d. of Cost.
Coal.	Per Cent	Per Cent	Per Cent.		s. d.	
Anthracite . .	93·0	4·0	3·0	15,000	25 0	111,000
Welsh—						
Good quality . .	87·3	3·06	4·0	15,200	29 6	95,760
Smokeless navigation	80 0	3·4	4·04	13,960	25 0	103,300
Average quality .	76·0	3·0	4·65	14,140	24 0	108,800
Scotch navigation .	70·6	2·6	4 8	13,760	23 9	107,328
Bituminous—						
Nottingham . .	57·1	8·0	5·11	13,000	20 0	120,900
Washed nuts . .	45·6	10·0	5 45	12,250	17 6	129,800
Coke.						
Foundry	90 0	7·0	0·5	13,500	28 0	94,500
Gas—						
From good quality coal, broken and graded . . .	88·0	8·0	0·5	13,100	20 0	121,800
Do., do.	88 0	8·0	0·5	13,100	18 0	134,900
Do., do.	88·0	8 0	0 5	13,100	16 8	146,700
Average quality, as sold	86·0	—	0·5	12,000	20 0	111,600
Do., do.	86·0	—	0 5	12,000	18 0	123,600
Do., do.	86·0	—	0·5	12,000	16 8	134,400

He found that the finest Welsh steam coal it was possible to buy was quoted at 29s. 6d. a ton delivered. This coal had a calorific value, according to the colliery owners, of 15 200 B.Th.U. per pound. This worked out at about 95,000 potential B.Th.U. for 1d. The next grade of Welsh coal—an average quality—at 25s., worked out at approximately 103,000 B.Th.U. per 1d. A Scotch navigation coal, which was almost smokeless, at 23s. 9d., worked out at 107,000 B.Th.U. per 1d. Taking washed bituminous nut coal, which sells at 17s. 6d. a ton, it worked out at 129,000 B.Th.U. The difference in the apparent value of these coals was very remarkable, because bituminous coal at 20s. a ton had almost the same calorific value as the Welsh coal at 25s. a ton. He had thought there must be some very remarkable reason, (apart from the smokeless characteristics) for this, so he had gone further into the matter, and had found that the cost was not in proportion to the calorific value, but to the percentage of fixed carbon, and in inverse proportion to the hydrogen content of the coal. The best Welsh coal had about 87 per cent. of fixed carbon and a hydrogen content of about 4 per cent.; whereas the bituminous coal had about 50 per cent. fixed carbon and a hydrogen content of nearly 6 per cent. The calorific value of hydrogen was 62,000 B Th.U per pound; but in a boiler furnace it might have a negative value. So that they could see the effect of even 1 per cent. of hydrogen on the apparent heating value of coal.

The calorimeter test gave the gross calorific value, but the net calorific value was something quite different; so that to purchase fuel on a calorific basis, though a useful method of comparison, was by no means a criterion. The actual value to the user was determined by the amount of useful work he could get out of it under his peculiar furnace and draught conditions. Furnace coke, at 28s. a ton, had only 0 5 per cent. of hydrogen, and worked out at 94,000 B.Th.U. per 1d. Gas coke, at 16s. 8d. per ton on the dry basis, worked out at 146,000 B.Th.U, and, including moisture and ash, an average sample gave 134,000 B.Th.U per 1d. The percentage of hydrogen in gas coke was 0·5 per cent, and the average proportion of fixed carbon was about 86 per cent.; while in the matter of smokeless combustion it was more than equal to the best grades of Welsh coal On the London market there was a certain amount of coke breeze, which in the ordinary way cost about 6s. a ton; but at present, owing to conditions brought about by the war, it cost 8s. 6d. at the gas works. This worked out, at the lower figure, at about 315,000 B.Th.U. per 1d. of cost.

Having suggested the best fuel value at present being offered in London—viz., gas coke—Mr. Nicol said he was in agreement with the author in advocating the use of carbonized fuel both from the point of view of economy and efficiency and from the national point of view of conserving the available coal, and also that of saving the valuable residuals which could be recovered only by modern carbonizing methods. With regard to the modifications desirable in boiler plant to enable them to use gas coke and maintain the normal maximum capacity of the boilers, he said that boilers were invariably designed to burn coal, and were rated on this assumption. A frequent difficulty with gas coke was, therefore, that the boilers could not do the work required; so that it became necessary to apply some sort of forced draught where little or no margin in boiler capacity was available. Under natural draught conditions, they obtained a temperature of (say) 2000° Fahr. in the furnace, whereas with a temperature of 3000° Fahr., obtainable with forced draught, the amount of heat passed through the boiler plate would be considerably more than doubled. There was no physical reason why the higher temperature should not be used; and a number of boilers were working at about this temperature. Many steam users objected to the use of forced draught on stationary boilers, whereas, perhaps quite unconsciously, they were using it on locomotive boilers on steam-waggons without any deleterious effects. Steam-waggons with fire-grates designed to use Welsh coal had been modified to use gas coke; and the necessary modifications were simply to open the spacing between the firebars to about ⅜ inch, and reduce the area of the exhaust cone in the chimney. This had the effect of increasing the draught. Steam-waggons so modified were hauling loads of 12 tons over country roads at the legal maximum speeds on gas coke exclusively. The heat expenditure per ton-mile remained approximately the same whatever kind of smokeless solid fuel was used; the main thing was to buy potential heat units in the cheapest market.

Another consideration in selecting fuel for breweries was the very important one of continuity of supply. In the event of a coal strike, supplies were likely to be cut off, and gas companies had usually to provide against this contingency by laying in very large stocks. Naturally the users of gas coke buying under contract benefited by these reserves. The abuse of fuel by stokers was very often due to the thickness of the fire carried being out of all proportion to the draught available. Under these conditions, there was set up a chemical reaction due to the oxygen supply to the upper strata of the fire being insufficient. The fixed carbon in the fuel was burnt on the grate-bars to carbonic acid. The reaction, which was a heat-absorbing one, was to carbonic oxide, and led to very considerable loss of heat and waste of fuel. The higher the proportion of volatile matter in the fuel, the greater would be the waste due to this cause. The evaporation of 7 to 8 lbs. of water per pound of coal, which the author had mentioned, was very interesting as a fair average for bituminous coal. On official trials, under ordinary working conditions, he (the speaker) had obtained 10·3 lbs. from and at 212° Fahr. per pound of gas coke, as fired—the coke being suitably graded to obtain the maximum rate of combustion per square foot of grate per hour. This rate was in the vicinity of 14 lbs. of coke per square foot of grate with 2-10ths inch draught over the fire. It was possible to work the rate up to 15 or 18 lbs. under better natural-draught conditions; the latter being about the normal maximum rate. Beyond this rate, forced draught became necessary unless the natural draught was exceptionally good.

Referring to the possible increase in the cost of coke fuel as soon as there came a run upon it, Mr. Nicol said the output of coke was at present limited to the demand by means of making gas from coke and oil instead of coal. While the output of coke was controlled by the use of oil gas, the use of the latter involved much higher cost in gas making. The difference in cost in making oil gas and coal gas would vary, of course, with the price of oil; but it was often something like 50 per cent. more than coal gas. The coke made for sale by the London and Suburban Gas Companies in 1913 was considerably more than 2,000,000 tons. If there were a sufficient demand for coke, instead of the price being raised the output would be increased to meet the demand, very much to the mutual benefit of the gas companies and the gas consumers, as well as to the users of coke fuel.

Testing Tar for Volatile Combustible.

The following question on the above-named subject was addressed to the Bureau of Information of the American Gas Institute; "In testing tar for the percentage of volatile combustible, it seems to be the practice to heat for seven minutes, paralleling the coal test. Is seven minutes selected because it is assumed that all the volatile matter is driven off in that time, and, if so, why? Or is it merely taken as a standard for comparison? The evolution of vapours from tar is so rapid that check tests disagree. If this is of sufficient importance to test at all, cannot more precise directions be given?" The question was answered by Mr. S. R. Church, of New York, as follows: "In testing tar for the percentage of volatile combustible, the method adopted by the Joint Committee on Coal Analysis is followed, both because it gives a standard for comparison, and because this test, when properly carried out, gives fairly concordant results. It is necessary, however, to gently heat the tar for a few minutes, until the tendency to foam, or the unduly rapid evolution of vapours, is past. Very precise directions follow: Weigh 1 gramme of tar into a 20 c.c. platinum crucible, having a tightly fitting cover. The crucible should be supported on a platinum triangle over a bunsen burner, having the distance from the bottom of the crucible to the top of the burner 6 to 8 cm. Previous to applying the full heat of the flame, the tar should be gently heated for a few minutes, until all tendency to foam is past. The crucible should then be heated for seven minutes over a full flame. The flame should be quite 20 cm. high when burning free. The test should be made in a place free from draughts. The upper surface of the crucible cover should be clean at the conclusion of the test; but the under surface of it should remain covered with carbon. The loss on heating, *minus* moisture in the sample, equals the volatile combustible matter."

IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY.

DEMONSTRATION OF THE EQUIPMENT IN THE FUEL LABORATORIES OF THE CHEMICAL TECHNOLOGY DEPARTMENT.

[An Illustrated Description of the Buildings and Laboratories, with some Account of the Course of the Work of the Students, appears on p. 390.]

A PARTY of probably sixty to seventy gentlemen accepted the invitation of the Governing Body of the Imperial College of Science and Technology, and of Professor W. A. Bone, D.Sc., Ph.D., F.R.S., to inspect, last Wednesday afternoon, the Fuel Laboratories of the new Department of Chemical Technology. Both science and industry were represented by the visitors, who had the pleasure of meeting the Rt. Hon. Sir Francis Mowett, G.C.B. (representing the Governing Body of the Imperial College) and Mr. Alexander Gow, M.A. (the Secretary of the College.) The visitors included Sir William Crookes, President of the Royal Society, Sir Robert Hadfield, F.R.S., Sir William Tilden, F.R.S., Mr. Robert Mond, Mr. Emile Mond, Dr. Rudolf Messel, F.R.S., Dr. J. E. Stead, F.R.S., Professor J. T. Hewitt, F.R.S., Mr. Henry Edmunds, Mr. Atkinson Adam, Dr. Rudolf Lessing, and Mr. A. C. Ionides. The President-Elect of the Institution of Gas Engineers (Mr. John Young) was present, and several members of the gas industry, including Mr. S. Y. Shoubridge, Mr. Thomas Glover, Mr. Hubert Pooley, Mr. C. F. Botley, Mr. F. W. Goodenough, Mr. H. James Yates, Mr. H. M. Thornton, J.P., Mr. George Keith, and several others.

The engagement was for three o'clock; and, soon after that hour, Professor Bone invited his visitors to commence the tour of inspection, which proved highly interesting and educative. In conducting the party through the buildings, and in demonstrating the use of the remarkable collection of apparatus in each department, Professor Bone was aided by his lecturers, demonstrators, and research assistants—Mr. J. W. Hinchley, Mr. Walter C. Hancock, Mr. E. Sinkinson, and Mr. S. Robson, whose particular *rôles* in the work of the laboratories will be found alluded to in the extended descriptive article elsewhere—together with some of the students, Mr. R. S. G. Knight, Mr. S. K. Wang, Mr. Blair, Mr. Howlett, Mr. King, and Mr. Goldstein.

It is unnecessary to particularly describe here what the visitors saw in the different laboratories, in view of the special article on other pages. But we may present a few notes made while passing through the rooms. Prefacing other particulars, it may at once be said that conversation among the visitors indicated that they were thoroughly impressed with the beauty of the whole building for the work to which it is being devoted. The roominess and airiness of the laboratories, and the completeness of their fittings and equipment generally, carried conviction that much useful work is going to be done here. Practically all the work that is being, and is to be, carried on has relation to solid and liquid fuels, gases, to the secondary products of the distillation of the raw material, the applications of gases, the combustion and heating properties of gases of various compositions and calorific values, and to the chemical and physical properties of refractory materials. Therefore the members of the gas industry who were of the party were particularly interested, and were able to foresee that there will flow from this centre of study and research much—both in men, knowledge, and results—that will be of considerable value to the industry.

The first room visited was the Refractory Materials and General Laboratory, in which some of the machinery was at work, and a muffle-furnace under fire, the temperature of which was the subject of test by several of the visitors by the aid of a Féry pyrometer. The reading was just over 800° C. Demonstration was made of the uses of the other appliances; and the disposition thus early was to linger, and to obtain a perfect grasp of the work of the testing apparatus and machines. However, the company eventually filtered into the Analytical Laboratory, where much of the apparatus was also in action—for example, that for the extraction of pyridine from coals, Archbutt's vaporimeter as used in the analysis of oil fuels, the Gas Referees' apparatus for determining sulphur in coal gas, Mr. Sinkinson's filter-washing apparatus, and the apparatus devised by Mr. Howlett (one of the students) for the extraction of solutions by liquids.

Upstairs, before visiting the main laboratories, the visitors spent some time in inquiring into the details and uses of the fine equipment found in Professor Bone's private laboratory, where he is continuing his investigations on the influence of hot surfaces on gaseous combustion.

The next large room examined was the Research Laboratory, in which work with light-apparatus is conducted. There is no doubt that the central feature of interest here was the demonstration of the new bolometric method of determining radiant efficiencies of gas-fires and the like, a description of which method was recently communicated to the Royal Society by Professor W. A. Bone, Professor H. L. Callendar, and Mr. H. James Yates. Assembled round the fire undergoing test by the new arrangement, Professor Bone explained the construction and action of the bolometer. The smallness of the instrument was matter of comment; and it was at once realized that the complication suggested to laymen in this work by the original description as published was altogether absent. From what was seen and heard, the visitors were persuaded that here there is an instrument which, for perfection in the matter of accuracy for testing radiant efficiencies, it will be difficult, if not impossible, to excel. Professor Bone's explanation was listened to with much interest; but we will not attempt to reproduce what he said, as he has kindly prepared for our readers the explicit account of the bolometer subjoined to these notes.

In the Research Laboratory devoted to work with larger appliances, there were several parts of the equipment in operation—such as the gas and air compressors. But the feature which courted and obtained most attention was the experimental regenerative gas-furnace designed by Mr. R. S. G. Knight, B.Sc., one of the students.

On returning from the inspection of the laboratories, a few minutes were spent in the dark room, hearing an explanation of the potentiometer apparatus for calibrating thermo-junctions.

Returning to the ground floor, the producer gas plant and 3000 cubic feet holder presented by Mr. Robert Mond was inspected, as was also the drawing-office, devoted to chemical engineering, about which remark is made in our special article elsewhere.

Outside the drawing-office, tea was kindly served to the visitors; and here they parted from their hosts and Professor Bone, feeling that the afternoon had been well spent amidst real living interest, and with the hope that the anticipations formed as to a highly successful future for the new laboratories would be fully realized.

The following is the description (supplied by Professor Bone) of the new

BONE-CALLENDAR-YATES BOLOMETER.

CONSTRUCTIONAL DETAILS—SEE ILLUSTRATION, P. 388.

The bolometer (shown in elevation in fig. 1 and in section in fig. 2) consists essentially of two exactly similar coils (A and B, fig. 1) of platinum wire wound on a thin plate of mica and coated to an even surface with hard black enamel, which coating is extremely durable, and can be cleaned without risk of injury. The two coils, each 1·7 inches square, and of 20 ohms resistance at a temperature of 20° C., are mounted back to back on either side of a circular gun-metal box CC (3·25 inches in diameter and 1·5 inches from front to back), provided with water circulation across the inner chamber D, and with suitable gun-metal covers EE for the coils, so that either coil can be exposed to the radiation or be screened, as required.

When both coils are screened, and are kept at the same temperature as the box, their electrical resistances remain equal, however much the temperature of the box may change. But if one of the coils is exposed to an external source of radiation, its temperature, and, therefore, its electrical resistance, are increased by an amount depending on the intensity of the radiation received by it. Consequently, the observed increase in the resistance of the coil is a measure of the intensity of the radiation received by it from the external source—*e.g.*, a gas-fire.

In making a determination of the intensity of the radiation received by the exposed coil, the two coils (one exposed to the source of radiation and the other screened) are connected with the opposite arms of a Wheatstone bridge through the two pairs of terminals marked 1 and 2 in fig. 1; while a current of water at the atmospheric temperature (or as nearly as possible at the atmospheric temperature) is maintained through the chamber D. If the temperature of the circulating water is less or greater than that of the testing room, a small correction (amounting to $\pm$ 0·028 ohm per 1° C. in the case of the instrument that was exhibited in Professor Bone's laboratory at the Imperial College) is applied to the observed increase in resistance of the exposed coil.

The determination of the increase in the resistance of the exposed coil is carried out in the usual well-known manner, which need not be further explained.

CALIBRATION OF THE BOLOMETER.

The smallness of the area of the absorbing surface (about 2·89 square inches only) is an important feature in the construction of the bolometer, since it enables the instrument to be calibrated in absolute measure from a standard source of radiation, thus avoiding altogether the error arising from the uncertainty of the absorption factor of the receiving surface, which is the commonest source of error in all measurements of radiation where the receiving surface of the instrument employed is large—*e.g.*, as in the R. H. Smith radiometer used in the Leeds method.

In the case of the new bolometer, the constant of the instrument (a number giving the intensity of the radiation expressed in either K.C.Us. or B.Th.Us. as the case may be, per square foot per hour for an increase of 1 ohm in the resistance of the exposed coil) is determined once and for all by comparison with a radio-balance—an instrument specially designed to give the total absorption of the radiation. This method of calibration is very accurate, and can be carried out in Professor Callendar's laboratory at the Imperial College, which is especially equipped with the necessary

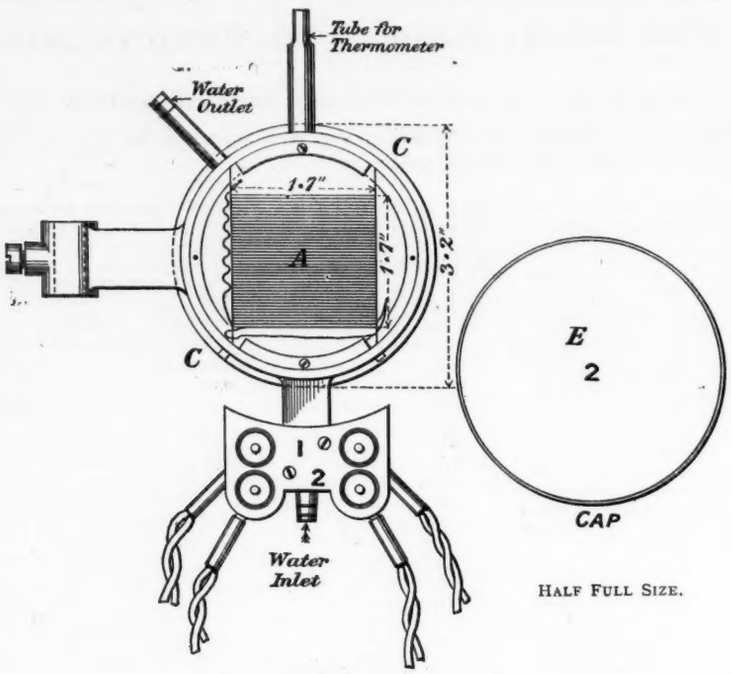


Fig. 1.—Elevation with Cap Removed.

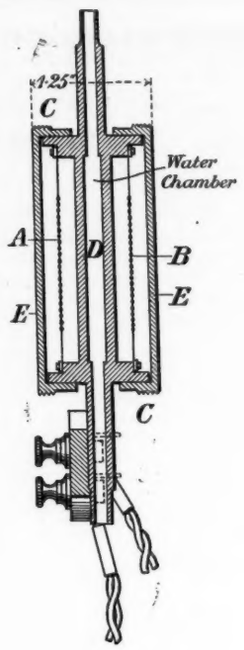


Fig. 2.—Section through Centre.

THE BONE-CALLENDAR-YATES BOLOMETER.

instruments for such work. And when once calibrated the "constant" of the instrument will not vary however long it may remain in use, provided that there is no accidental fracture in its working parts caused by a fall or rough usage. The "constant" of the instrument exhibited and demonstrated in Professor Bone's laboratory last Wednesday afternoon is 27·81 K.C.Us. per square foot per hour for an increase of 1 ohm in the resistance of the exposed coil of the bolometer. The "correction" to be applied for a difference between the testing-room temperature and that of the water in the circulating chamber D of the bolometer is 0·028 ohm per 1° C.

Determination of Distribution Factor.

The "distribution factor" of a gas-fire, or other approximately flat source of radiation, may be defined as the factor by which the normal intensity at a given distance D must be multiplied in order to obtain the total radiation emitted over a hemisphere. If the source is a plain circular disc of uniform intensity and of radius R, the value of the factor given by the theory of radiation for a self-luminous surface would be simply $\pi (D^2 + R^2)$. Thus, for example, in the case of a plane circular source 1 foot in diameter, tested at a distance of $9/\pi$ feet, or 34·4 inches [the distance employed in the Leeds method], the value of the distribution factor would be 26·58.

In the case of a gas-fire, however, the surface is seldom flat, and there are considerable extensions (such as the canopy) which contribute an appreciable fraction of the radiation. Therefore the "distribution factor" 26·58 cannot be assumed, but must be measured for each particular fire. It appears, however, from theory, and also from comparison of observations, that the sum of four readings taken at 60° along the equator and meridian, together with the central reading, multiplied by $\pi D^2/3$—*i.e.*, by 8·6 when $D = 9/\pi$ feet—may be taken as the measure of the total radiation received over the whole hemisphere. The "distribution factor" is thus the sum of the five readings in question divided by the central reading and multiplied by $\pi D^2/3$—*i.e.*, by 8·6 when $D = 9/\pi$, as in the Leeds method.

Advantages of the Bolometer.

The principal advantages claimed for the new bolometric method over the Leeds radiometer-*cum*-thermopile method, or indeed any other similar method, are:

1.—Its much greater sensitiveness and accuracy.
2.—The "absolute" character of the results obtained.
3.—The elimination of all errors and uncertainties inherent in radiometers of the water-calorimetric type, or of the necessity for introducing "cooling corrections" as in other types.
4.—The portability of the instrument and the quickness of its action.
5.—The fact that, if necessary, the bolometer can be used in conjunction with a recording instrument, such as the Callendar recorder, whereby not only is the personal error of the particular observer eliminated, but also the results are automatically recorded in a permanent visible manner, and can be produced at any time as indisputable evidence of the test.

[We understand that arrangements are in progress for the construction of the new bolometer, and the requisite necessary instruments for making the measurements of electrical resistance in a simple and compact form, by a well-known firm of instrument makers, as well as for the proper calibration of each instrument issued; so that it will not be long before the new method will be available to the public. A further announcement about these arrangements will be made by the authors of the method, or on their behalf, in due course.]

VARIETY IN THE SALES DEPARTMENT.

The Seizing of Opportunities.

New conditions demand new methods; and so far as the gas industry is concerned, this demand has undoubtedly during recent years insistently made itself felt in connection with the distribution side. The days when business came practically without being sought have gone for ever; and they have been succeeded by times of strenuous competition on the part of a vigorous rival. This has, of course, as everyone knows, been of the greatest benefit to the industry; for never before was it possible for gas to have the chance that came to it along with the necessity for organizing the Sales Department. The success that has attended the development of this branch of the business, we see all around us; and the failure—nowhere. Show-rooms and canvassing methods have been improved beyond all recognition; and the claims of gas are being asserted with a force that will not be denied, both in old and new directions of use. Opportunity has arisen from time to time of noting what is being done in this way by the large Metropolitan Gas Companies, and other undertakings working on similar lines; and reflecting on the matter, it occurs to one that perhaps the most fascinating part of the duties of those connected with the sales department must be the exploring of the less familiar channels of business. An absolutely new field is, of course, very difficult to hit upon, inasmuch as gas has been utilized for almost every imaginable purpose in one place or another; but installations out of the everyday run of things can be secured, as the reward of those who hunt for them with sufficient energy and perseverance.

One or two examples of this have come to the notice of the writer in the district of the South Suburban Gas Company—an area which, with its enlargement by amalgamation from about 17 square miles to some 90 square miles, offers fine scope for the activities of the sales department that has recently been formed, with the object of adequately supporting the claims of gas. As with the undertakings on the lines of whose operations the South Suburban Gas Company are following, the whole idea underlying the scheme is, of course, to get into close touch with architects, builders, landlords, tenants—and in fact, anybody and everybody who can be of the slightest assistance to the officials in increasing the sales of gas—and let them know just what the Company are prepared to do, and what the consumer is likely to gain from its being done. Systematic canvassing throughout the district has been undertaken, though the desire now is to refer briefly, not to everyday domestic supplies, but to one or two of the rarer opportunities of doing fresh business which have

been seized by those engaged in the Sales Department of the South Suburban Company.

Church Lighting.

To begin with, there is the Perry Rise Baptist Church—a new building which is lighted throughout by means of gas. Though gas-lighted places of worship are very frequently met with, they usually represent a real victory for gas, owing to the keenness of electrical competition for them. This remark applies fully to the present instance. The lighting scheme adopted is one which quite harmonizes with the building, and produces an excellent shadowless illumination that has caused the greatest satisfaction to the congregation. For the main lighting of the church, there are nine of Sugg's black iron special gas-fittings, provided with diffusing globes. Six of the lamps contain clusters of five No. 2 burners, and three clusters of eight. As the candle power of the respective lamps is about 250 and 400, they give a total illuminating effect of 2700 candles; the consumption being something like 120 cubic feet of gas per hour. This, of course, is with all the lamps going; but actually they are controlled while the service is in progress. There are four switches fixed in the porch, to control the whole of the nine lamps, which are fitted with mercurial seals and a separate pilot-light supply. The church has been open for two months; and there has been no break in the smoothness of the main lighting arrangements, which are supplemented by brackets at different points.

Gas at a Rifle Range.

Another striking victory which has been secured for gas in the Company's district, is in connection with a rifle-range at Sundridge Park, Bromley, where an old range illuminated by electricity has been replaced by three new ranges, of 25, 50, and 100 yards respectively, lighted by incandescent gas. Each target is lighted by means of two Sugg three-light "Regent" lamps, fitted above the target about 3 feet from the ground. The lamps have steel reflectors, and are protected in front by a screen of mild steel, 8 feet long and 3 feet wide, covered by match-boarding. The lights at the 25 feet range are controlled from the firing-line by means of a bye-pass cock. At the firing-line, too, there are a series of gas-burners with reflectors; so that rifle practice by members of the club and volunteers can be carried on at any time. The ranges are first-class in every way; and that the lighting is not by any means the least striking feature about them is evident from the fact that the Secretary of the Sundridge Park Golf Club (who are responsible for the ranges) expresses himself as highly satisfied with the illumination. With the present unhappy need for so much rifle practice, there should be the possibility of a greater use of gas in this direction.

Generating Current for a Theatre.

At the beginning of last month, there was opened in the Beckenham Road, Penge, the "Empire" theatre, which has been erected at a cost of about £30,000. Outside this building, supplies have been laid in by the contractors to six points, for high-pressure gas; and it is hoped that, when the existing lighting restrictions are relaxed, Keith lamps of 1500-candle power will be used for facia lighting. The Company, it may be mentioned, already have a high-pressure main in the road; and in normal times a compressor-station in the vicinity supplies through this a number of lamps. Gas is also used for providing hot water for mullers in the bars.

Current to meet the whole of the requirements inside the theatre is generated by two 34-h.p. "National" gas-engines and belt-driven 21 k.w. dynamos; the gas being supplied through a 3-inch service and a 200-light meter. The average consumption of gas per week is 35,000 cubic feet. The engines are started by compressed air; and there is twin ignition—high-tension magneto and hot tube. No electric cable enters the theatre at all. This plant was installed on the advice of the Consulting Engineer to the Theatre Company, after very keen competition by the Electric Light Company; so that it, again, may be claimed as a substantial victory for gas.

A Searchlight Station Gas Supply.

In connection with a searchlight station and officers' and crews' quarters at One Tree Hill, Honor Oak Park, some 109 yards of 3-inch service pipe have been laid from the bottom to the top of the hill at the request of H.M. Office of Works. This supplies gas through three meters for a 26-h.p. "Crossley" engine, connected to a belt-driven dynamo, generating current for an Admiralty searchlight. In addition to this, two cookers and several large gas-fires are installed; while all the quarters are lighted by incandescent gas.

These few recent installations in the district of a single company serve to show the variety of the work, and of the knowledge, required to-day from the outdoor staff of a really progressive gas undertaking.

Sir Alfred Plantagenet Frederic Charles Somerset, K.C.B., Hon. Colonel, 6th Rifle Brigade, of Enfield Court, Enfield, Middlesex, the Chairman of the Enfield Gas Company, whose death on the 26th of March last, at the age of eighty-five, was noticed in the "Journal" at the time, left unsettled property of the gross value of £87,305, of which £66,220 is net personalty.

HEAT IN A GAS-ENGINE CYLINDER.

A Paper at the Institution of Mechanical Engineers.

In a paper submitted to the Institution of Mechanical Engineers last Friday, Professor A. H. Gibson, D.Sc., and Mr. W. J. Walker dealt with the "Distribution of Heat in the Cylinder of a Gas-Engine." The investigation outlined in it was, to some extent, the outcome of a suggestion made by the Committee of the British Association on Gaseous Explosions in their report for 1912. The Committee were not aware that any accurate measurements of jacket loss at different speeds had ever been undertaken; and from some rather rough measurements of this character it appeared that the heat loss per cycle diminishes with increase of speed, but not in proportion thereto. Altogether some 130 trials were carried out, with a view to determine how the distribution of heat through the engine varies with (1) the speed, (2) the brake horse power, (3) the compression ratio, and (4) the richness of the air to gas mixture. The normal speed of the engine was 200 revolutions per minute; but in the trials a range of speeds from 140 to 260 revolutions per minute was recorded. Town gas was used; its net calorific value (calculated), at standard temperature and pressure, being 521·4 B.Th.U. per cubic foot. The main results of the investigation thus carried out may be summarized as follows.

The mechanical efficiency of the engine increases with increasing loads, diminishes as the ratio of air to gas increases, diminishes as the speed increases, and is sensibly independent of the compression ratio. The maximum efficiency attained in these trials—*i.e.*, at full load with the richest (7 : 1) mixture and at the lowest speed (150 revolutions per minute) was 88 per cent. At the normal speed of 200 revolutions per minute, and with the same mixture, the efficiency was 85 per cent.; while with this same speed and the weakest (11 : 1) mixture it falls to 76·7 per cent.

The thermal efficiency as measured on the indicated horse power increases with the load, attains a maximum with an air to gas mixture of approximately 10 : 1, and increases very slightly as the speed and compression ratio increase. The thermal efficiency as measured on the brake horse power increases with the load, attains a maximum with an air to gas ratio of 8 : 1—*i.e.*, with a richer mixture than gives the maximum indicated horse power efficiency—diminishes as the speed increases, and increases with the compression ratio.

The ratio of the actual thermal efficiency, measured on the indicated horse power, to the corresponding air-cycle efficiency, increases with the load, has a maximum value when the ratio of air to gas is approximately 10 : 1, increases slightly with speed, and is sensibly independent of the compression ratio.

The percentage exhaust losses diminish as the load increases, and very slightly as the ratio of air to gas increases, increase with the speed, and diminish as the compression ratio increases. At full load the exhaust losses in these trials lay between the limits of 33·6 and 42·5 per cent. The former value corresponds to a weak mixture, high compression, and low speed, and the latter to a rich mixture, low compression ratio, and high speed.

The percentage of heat carried away by the water flowing through the cylinder jackets—not including the exhaust-valve jacket—increases with the load, diminishes as the ratio of air to gas increases and as the speed increases, and is sensibly independent of the compression ratio. With the strongest mixture, and at full load, the percentage of heat transmitted to these jackets is 1·10 times as great at 150 as at 250 revolutions per minute; while with the weakest mixture the ratio becomes 1·23. Since at 150 revolutions per minute the period of contact per cycle of hot gases and cylinder wall is 1·66 times as great as at 250 revolutions per minute, the rate of transmission of heat through the cooling surfaces is evidently much greater at the highest speed.

The radiation loss—that is, the balance of the heat accounted for as indicated work in the exhaust and in the jacket water—diminishes as the load increases, increases as the ratio of air to gas increases, diminishes as the speed increases, and increases slightly with the compression ratio. At full load, radiation accounts for between 5 and 14 per cent. of the heat given to the engine; the former value obtaining with a rich mixture, high speed, and low compression ratio, and the latter with a weak mixture, low speed, and high compression ratio.

Since part of the heat carried away by the jacket water passes into the cylinder walls after release, this should, in a true heat balance, be credited to exhaust. The item attributed to radiation represents heat lost by radiation from the hot exposed surfaces of the piston and of the unjacketed portion of the breech, and from the outer surface of the jackets. Though this loss is wholly due to heat flow through the walls, only part of this flow takes place during the expansion stroke. The remainder, occurring after the end of this stroke, is also to be attributed to the exhaust.

A true heat-balance for this portion of the cycle can only be deduced if the heat given per cycle in the combustible gas, the work done per cycle, and the energy of the working fluid at the end of expansion, are known. In order to determine the energy at the end of expansion, it is necessary to know—(1) the temperature at the end of expansion, (2) the quantity of the working fluid in the cylinder, and (3) its internal energy per cubic foot in terms of its temperature. In these trials all the data necessary for determining the first and second items were available.

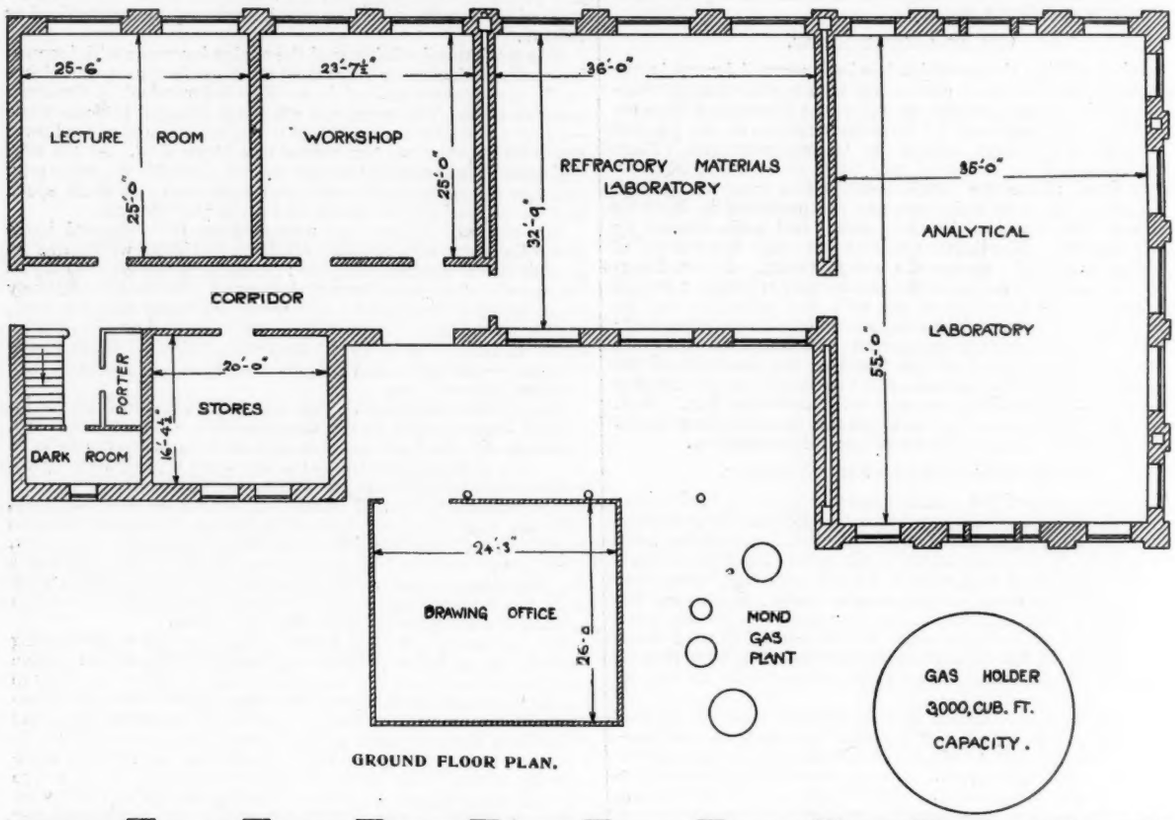
IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY.

Department of Fuel and Chemical Technology.

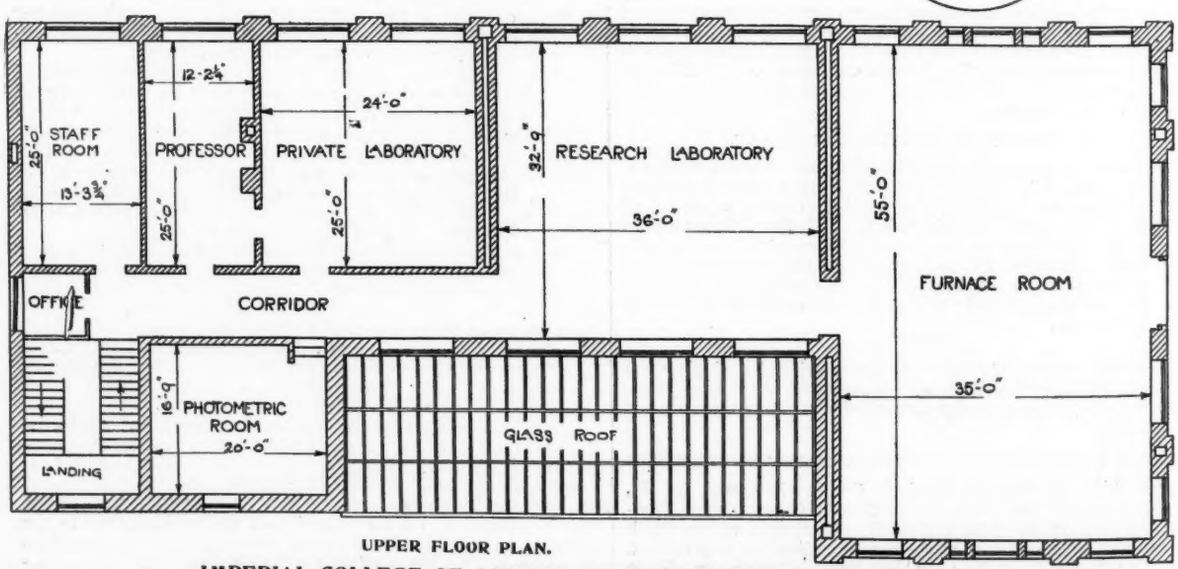
LYING off the Knightsbridge Road, at the rear of the Royal Albert Hall, is the Imperial College of Science and Technology; and fronting on Prince Consort Road, are the new buildings which have been assigned to the study of, and research in, fuel and chemical technology. Before making acquaintance with the interior, the buff brick walls, the large expanse of steel framed factory type of windows, and, in fact, the external appearance generally of the structures, give one the impression that within practical methods must be associated with the high scientific work proceeding there. One hears much in these days about theory and practice, and about applied science; and from what is said, there is always current among laymen the idea that scientific study and exploration are altogether apart from everything that is practical, and cannot come into touch with things practical until knowledge and discovery are reduced to some material use. A visit to the Fuel Laboratories of the Department of Chemical Technology of the Imperial College must dispel any such notion from any mind; for the impression gained by a prior outside inspection of the buildings is confirmed as one walks through the spacious, light, airy, well-ordered laboratories, and makes an inspection, under the guidance of the head of the department—Professor W. A. Bone, D.Sc., Ph.D., F.R.S. The laboratories, equipment, and all else tell the visitor plainly that this is a place where thoroughly practical methods underlie study of, and research into, fuel and cognate chemical problems associated with the industrial arts.

THE GENESIS OF THE DEPARTMENT.

Before describing the buildings, and the equipment, a little explanation should be made regarding the origin of the department. The Imperial College of Science and Technology is the outcome of an amalgamation of three previously independent institutions—viz., the Royal College of Science, the Royal School of Mines, and the City and Guilds Central Technical (Engineering) College. Just after the South African war, two well-known South African millionaires—Sir Julius Wernher and Mr. Otto Beit—presented a large sum of money for the development of higher technical education; and the outcome of the bequest was a scheme for the extension of



GROUND FLOOR PLAN.



UPPER FLOOR PLAN.

IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY AT KENSINGTON.

the three colleges, which, under charter, then became the Imperial College of Science and Technology—Sir Alfred Keogh, K.C.B., LL.D., being now the Rector. Embraced in the scheme, as it was developed by the governing body, was the erection on a site opposite to the Imperial Institute, of buildings for the Departments of Pure Chemistry and Physics, which subjects were transferred from the old Royal College of Science, which was then allocated to mathematics and biological sciences; the Royal School of Mines was rebuilt and retained for mining; and the City and Guilds (Engineering) College was extended, and this is now the Department of Civil, Mechanical, Electrical, and Hydraulic Engineering.

Simultaneously with the reorganization of the Royal College of Science, the School of Mines, and the City and Guilds (Engineering) College, the governing body turned their attention to a scheme for the development of Chemical Technology, for which a vacant site was available in Prince Consort Road, with a frontage of 230 ft. by 210 ft. in depth. A Special Committee was appointed in 1907 to consider the lines that this new development should pursue. Glancing down the list of the members of the Committee, the names are seen of men of the very first rank in scientific and industrial achievement and fame. The report they made as the result of their deliberations is a document of real worth in relation to higher scientific study. A considerable part of it dealt with chemical technology; and their recommendations (to put them briefly) amounted to this: That there should be five sub-departments of chemical technology, each with its own professor, but organized under a directing head, who should be chief professor of chemical technology. The first of these sub-departments was to be for the special study of fuel and heat transmission; the second, for chemical engineering—that is to say, for instruction in the design and operation of chemical plant; and the third for electro chemistry. The scheme has been slightly modified in detail from the report. But the two first-named sub-departments—fuel technology and chemical engineering—are the ones for which the first section of the new buildings has been erected. It is hoped to add shortly the third sub-department for electro chemistry.

The Buildings and Prospective Schemes.

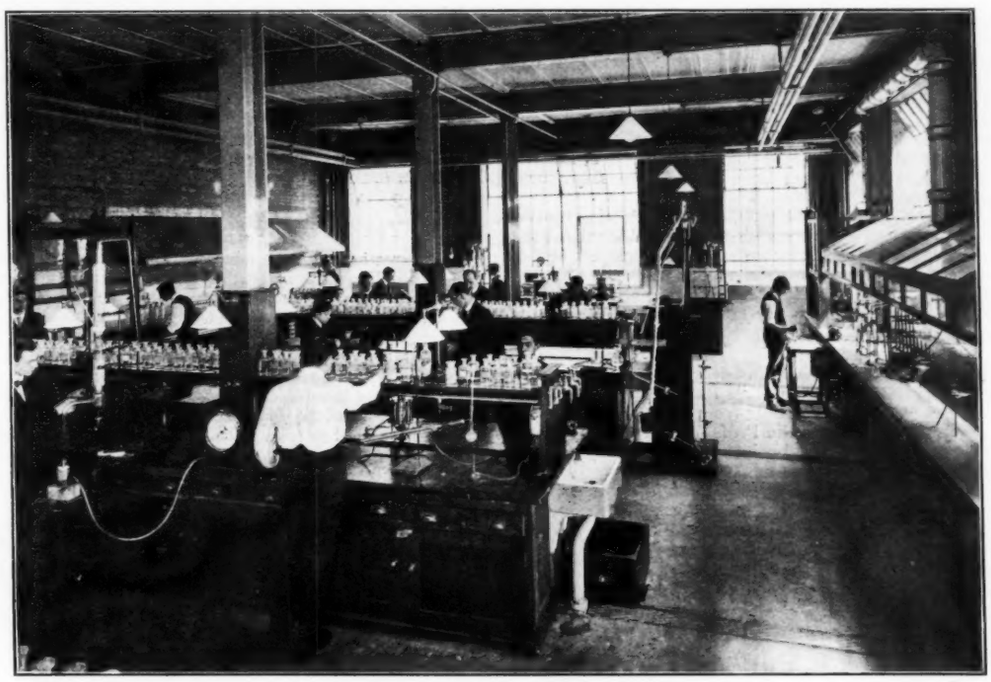
So much for the genesis of the new department; and now for its practical organization. It was in 1912 that Dr. Bone was appointed Chief Professor in Chemical Technology, with instructions to organize the scheme as a whole, and to begin with Fuel and Chemical Engineering. His first business was to advise the College authorities as to a building scheme suitable both to the site selected and to the ultimate development and ramification of chemical technology generally. As inspection is made of the buildings constituting the first wing of those which it is hoped in time to see constructed, and of the architectural and equipment details of the laboratories, it is clear that Professor Bone has had a busy time the last three years, and has succeeded in very thoroughly organizing the department.

With plans before him, Professor Bone explained to the writer that the basic idea with which he started, and on which the plans were prepared, were that on the site there should ultimately be a building with a front and two wings, leaving a big area in between which could be utilized for putting-up temporary buildings for special technical researches. The wing so far constructed is the one in which is housed the Fuel and Chemical Engineering Department. At the present time it is a two-storied structure; but the walls have been built in very substantial manner with the view to two additional floors being added. As a matter of fact, the design contemplates that each wing together with the front shall eventually constitute a four-storied building occupying three sides of a deep rectangle. Therefore really only a comparatively small part of the ultimate building has been erected; but this part is complete for all present purposes and needs. It may be mentioned here that from the time the final design and drawings were settled, there was no alteration whatever made during the actual erection, and the building was finished within the original estimate.

General Internal Architectural Features.

Entering the building by the end door, one notices first that the corridors, with their Ruabon buff-coloured bricks at top and chocolate-coloured glazed bricks below, are broad and light. Walking along the corridor to the further end, one passes through a door, with the upper panels glazed, into the Refractory Materials Laboratory. Across this—straight ahead—is the Analytical Laboratory, into which one enters through a door, also glass-panelled at the top. These glass panels in the doors, it is gathered, serve a two-fold purpose—they enable an inspection of the room to be made without disturbing the students; and they prevent anything in the way of a collision between anyone entering a room and someone leaving it, maybe carrying some piece of valuable chemical apparatus.

We are now in the Analytical Laboratory, which is 55 ft. by 35 ft., with an internal height of 15 ft. This height applies to all the rooms. Here may be mentioned as general features applying to all the laboratories that the internal walls are of buff brick, with dado of white glazed bricks. The windows have large area, and so the light, on which the buff-coloured bricks have a softening influence, is very good.



THE ANALYTICAL LABORATORY.

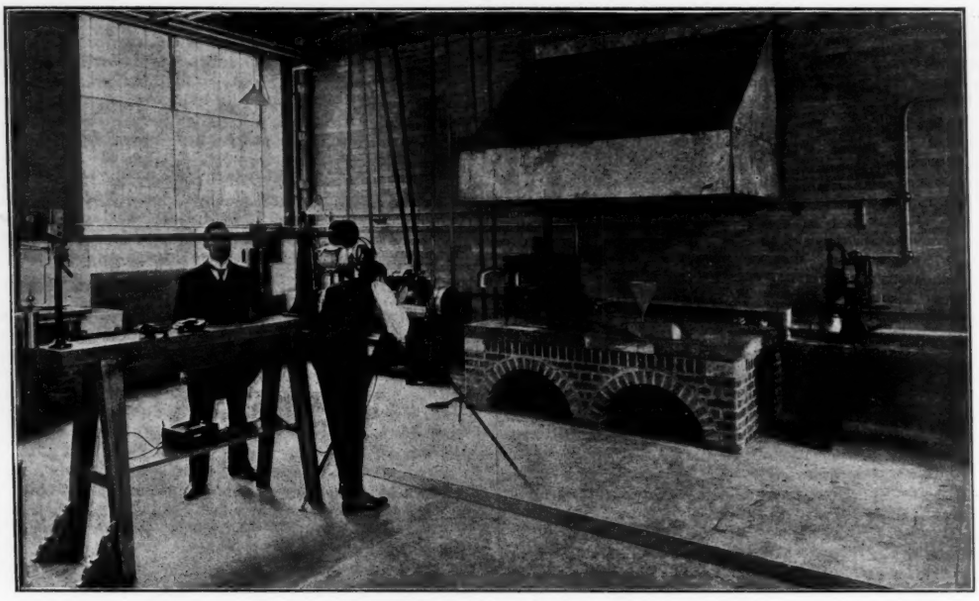
[The excellent series of photographs accompanying this article was taken, to Professor Bone's instructions, by Messrs. John H. Avery and Co., of Hillmarton Road, N.]

The adjoining Refractory Materials Laboratory, into which we return, has a superficial area of 36 ft. by 32 ft. 9 in.

Back into the corridor, a peep is made into the Workshop, which is 25 ft. by 12 ft.; and next to this is the Store-Room. The equipment of the laboratories is being left for general description presently. But a few words may at once be said about the workshop. It is fitted up with the necessary machines, hand tools, and material, in order that all repairs to the research instruments, &c., may be effected on the premises, and any new serviceable instruments devised by anyone—even by the students, if approved by Professor Bone—can be made here. The workshop is in charge of Mr. H. F. Reynolds, whose mechanical training was received in the workshops of the Cambridge Scientific Instrument Company.

On the opposite side of the corridor is a door leading out under a large glass-covered space, just beyond which is the gas plant [about which more will be said later], and next to which is the Drawing Office, 26 ft. by 25 ft., with top lights as well as side windows, and suitably fitted with drawing benches, easels for drawing, &c.

In the original plans, on the ground floor but beyond the main



A VIEW IN THE REFRACTORY MATERIALS DEPARTMENT.

building, provision was made for a large lecture-room; but it was decided, for the present at all events, to cut this out. Re-entering the corridor, and passing beyond the store-room, there is the apartment which has been temporarily allocated to the purposes of Lecture Room. This has a floor area of 25 ft. by 25 ft. It is fitted with a raised daïs for the lecturer, blackboard, lantern and screen, desks (one for each student), and all necessary accessories for lecture work.

This completes the rooms on the ground floor. Passing up the flight of stone stairs to the upper floor, and walking along to the far end of the corridor, there are two laboratories corresponding in size to the Analytical Laboratory and the Refractory Materials Laboratory on the ground floor. The farther one (measuring 55 ft. by 35 ft.) is the Research Laboratory for Heavy Plant and Apparatus, and that through which one has to walk to reach it is the Research Laboratory for Light Apparatus, the dimensions of which are 36 ft. by 32 ft. 9 in. Retracing steps into the corridor, we come to Professor's Bone's Private Laboratory, which is 24 ft. by 25 ft. A door leading from this (or one leading from the corridor) takes us into the Professor's Private Room, and one finds himself here in a business-like atmosphere. Its general appointments suggest that it might be the office of the chief of a business house; indeed it is only the contents of a large book case which indicate its real character and purpose. Truly, it is an important "business" that is conducted from this room—shaping men's careers and their ambitions in the world of scientific work. Adjoining this is a Room for Lecturers, Demonstrators, and Research Students, fitted-up for study and writing. On one side of this room is a reference library; and, on another side, a large cupboard, with glazed doors, in which are kept, under lock and key, many delicate and expensive instruments and pieces of apparatus for research use. To this room, lecturers, demonstrators, and students can retire for reference to literature, quiet reading, and writing. Almost opposite Professor Bone's room, on the other side of the corridor, is a Dark Room (17 ft. by 20 ft.), with blackened ceiling and walls, in which investigations requiring absolute darkness can be carried out. Among other apparatus in this room is a potentiometer equipment for calibrating thermojunctions.

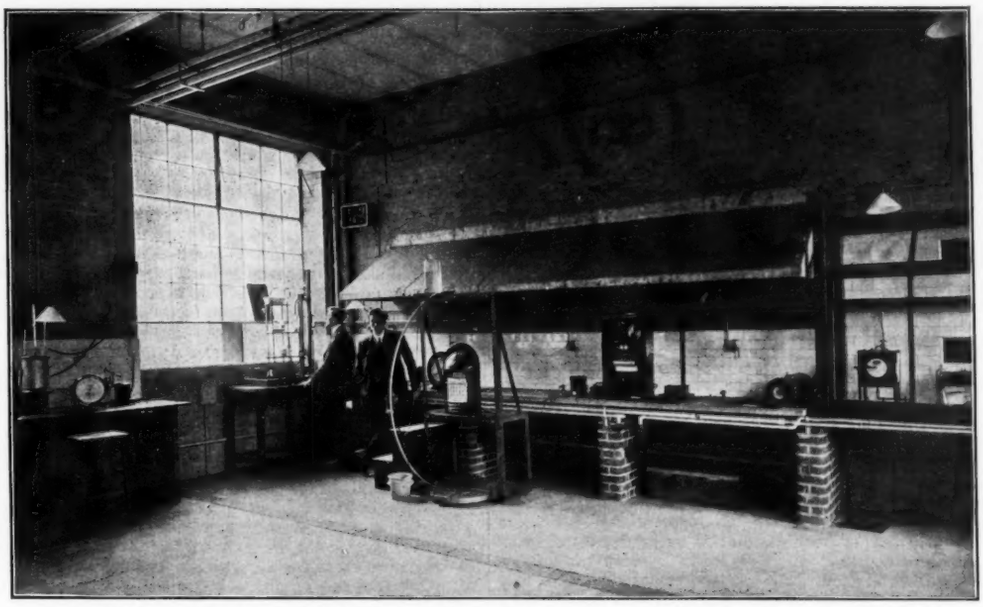
The System of Heating and Ventilation.

In connection with the constructional work and general survey of the buildings, the system of heating and ventilation is especially noteworthy. The establishment is electrically lighted; the current being supplied by the Office of Works. But the heating of experimental furnaces, crucibles, and so forth is done by gas. In view of the chemical fumes and the large quantity of gas burned for heating under the spacious hoods over the several benches in the laboratories, special attention has been paid to the heating and ventilation systems.

The method of heating is by hot-water pipes, with valvular control on the rising-pipes; but the heating-pipes, quite contrary to the usual custom, are suspended from the ceilings. There are three main advantages in this:

1. There are no heating-pipes or radiators on the floors, occupying room that can be better devoted to other purposes.
2. The pipes are entirely removed from all contact with gas and water pipes; and so the temperatures of the gas and water are not adventitiously interfered with.
3. The incoming air, being drawn in from the tops of the

THE LARGE RESEARCH LABORATORY, SHOWING THE GAS AND AIR COMPRESSING PLANT, THE HIGH-PRESSURE METER, AND M'KNIGHT'S FURNACE (IN COURSE OF CONSTRUCTION).



THE SMALLER RESEARCH LABORATORY, SHOWING THE BONE-CALLENDAR-YATES BOLOMETER IN USE TESTING THE RADIANT EFFICIENCY OF A GAS-FIRE.

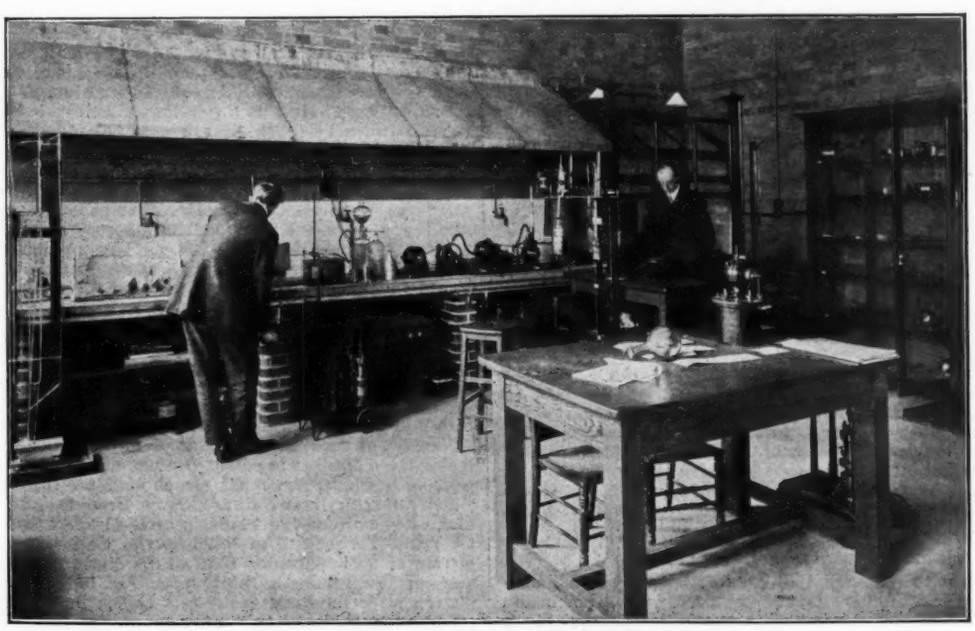
windows, has "its chill taken off" by the hot pipes and warm upper air before its forced descent, owing to the working of fans, as presently explained.

The ventilation and heating are thus linked together, which is quite the proper thing, and the most efficient of methods. The division-walls between the laboratories are chambered; and these chambers are connected-up to five powerful electric-fans, located at appropriate points. The hoods over the benches in which the heating of furnaces, &c., proceeds have no unsightly shafts at the top; but openings at the back lead into the chambers in the division-walls. Upon these openings the fans draw, and suck away all the fumes from the operations proceeding below. Not only so, but the same suction promotes the ventilation of the whole of the laboratories; and in this way: The windows, as mentioned in the opening of the article, are of the steel-framed factory type, of which the two uppermost sections form a hinged flap opening backwards into the laboratories. Fresh air is thus drawn in through these upper openings of the windows; the air as already explained passes (in winter) over the heated pipes, and then travels downwards to the bottom level of the hoods over the benches (which is about the height of one's head), from which point the fans drawing on the flues in the division-walls at the backs of the hoods exert an action that keeps the air of the laboratories in excellent condition. Of course, the fans can be varied in speed to suit the prevailing circumstances.

As to the efficiency of the systems of heating and ventilation, tests have shown that the temperature of the laboratories can be maintained at a uniform stage to within 3° Fahr. on any day. The air throughout the building can also be changed in a brief space of time, if necessary, by operating the fans at full speed. Even on a day when high temperature furnace operations are in progress in the building the air in the laboratories, through the system of ventilation, has been found as fresh in the afternoon as in early morning. The amount of heat, too, that is being put into the building can be readily determined. The number of gallons of water passing into the system is known, and the temperatures of the ingoing and outgoing water are taken. The difference shows the number of calories that have passed into the building. The systems of heating and ventilation are each, and in combination, as good as could be devised for such large laboratories. There is quick control of both; and the healthy conditions under which work proceeds must make for greater and sustained capacity in the students.

Gas, Water, Steam, and Other Services.

For the experimental work, a system of pipes for gas and water supplies is laid in accessible positions overhead, along walls, benches, and in floor channels covered by cast-iron plates. There is also a supply of steam available where required, while electric power cables are found in all the principal laboratories; moreover, an air-blast, generated by an electric-motor, is laid all over the building, so that air under pressure is available for any experimental work. Conveniences such as these facilitate work, and encourage experiment. An internal telephone system is also fitted throughout the establishment; so that Professor Bone can



IN PROFESSOR BONE'S PRIVATE LABORATORY.

at any moment communicate from his room with the various laboratories in the building.

Pre-Qualification of Students, and Course of Study.

One little piece of information, gathered, by the way, from Professor Bone, may be usefully interpolated here, before dealing with the equipment of the laboratories. The courses in chemical technology are all post-graduate in character. A student must have graduated in some University, with the degree of B.Sc., or possess an equivalent qualification in pure science, mathematics, physics, and chemistry. He thus enters the new department of the Imperial College in what may be considered as his fourth academic year, and his subsequent post-graduate course is drawn up to cover two years. But there is no restriction to two years. The student may stay longer, if he thinks proper and is regarded as a suitable student.

When the student enters the department, he begins in the Analytical and Refractory Materials Laboratories, which are under the immediate charge of Mr. E. Sinkinson, who has had special previous experience in these particular branches of work. Mr. Sinkinson came from Sheffield, having passed through the Sheffield University, with subsequent practical experience in some of the analytical laboratories in that industrial city. He was, in short, selected for his special qualifications and experience in the work of technical chemical analysis. These two laboratories are specially equipped for the complete examination of fuels and refractory materials, together with all the bye-products arising from the treatment of fuels, whether from distillation or in any other way. The work on fuel, of course, includes calorimetry and gas analysis. In addition to solid fuels, oil fuels are examined by all the recognized methods. The distillation of tar, ammoniacal liquor, and other liquids also forms part of the study and investigation, as do also the analysis of refractory materials and research work into their physical and mechanical properties. The student spends three days per week of his first year of post-graduate training between the Analytical and Refractory Materials Laboratories. The other two days of the week—Monday and Friday—he spends in the Chemical Engineering Drawing Office under the direction of a special lecturer, Mr. J. W. Hinchley, who takes the men through a systematic course on the design and construction of chemical plant.

In the light little drawing-office, situated outside the ground floor corridor of the main building, and suitably equipped, Professor Bone explained how he regarded this work—the design and construction of chemical plant—as a unique and valuable feature of the department. In his previous experience, he has felt how much this sort of thing was required as a supplement to the other part of the training of a student in chemical technology. Here he is taught how to construct, for example, a benzol still, an ammoniacal liquor still, an evaporating vessel, and so on. The idea is that the student will, during the session, take a few typical pieces of plant of this sort; and then, under the direction of the instructor, will design them *ab initio*—experiments being carried out by him to obtain the underlying data for the design. For instance, in the case of an evaporating vessel, he will find out how much surface he will require for doing a certain amount of work, or for gas cooling how much condensing area he will want. He then evolves the design, without being hurried in any way, working from his own experimental factors. Having got out the design, he makes a full working drawing, frames a specification, and makes an estimate—all under the guidance of his technical instructor. In this way, the student designs, and thoroughly grasps the constructional necessities and details, of a few simple, typical pieces of commonly used plant. Of course, he does not undertake the design of a structure such as a carbonizing plant. But through what he does here, he is turned out with some fundamental engineering knowledge concerning parts of plant with which, as a chemist he will be brought into contact, and which knowledge will enable him to design alterations and improvements in plant. Without such fundamental knowledge he would not be in a position to do these things; and therefore the chemist with such knowledge is better equipped, and must be of greater value, than the chemist without it. This needs no argument; and therefore one can readily agree with the view of Professor Bone that this is a valuable feature in the work of the department.

The Equipment of the Laboratories.

Altogether, about £15,000 have so far been spent on the Department for Fuel and Chemical Technology; but, at the time the war began, only about half of the money allotted to equipment had been expended, and then owing to circumstances arising out of the war the Governors of the Imperial College decided to suspend all further capital expenditure for the time being. To put the position in round figures, the outlay on equipment (excluding the producer gas plant generously presented by Mr Robert Mond) has been about £2000; and there is, practically speaking, another £2000 to be spent. All the apparatus required for ordinary purposes has, however, been obtained; and, as conditions at present exist, the further outlay contemplated will only be incurred during the next two or three years as the research requirements of the department demand.

In the Analytical Laboratory.

Returning now to the large Analytical Laboratory (the dimensions of which, as of the other laboratories, were given in describing the general plan of the building) to inspect its equipment. It is observed, in the first place, that each student has his own working-bench and cupboards, and all the ordinarily required chemicals are supplied to him. Incidentally noticed on the working-benches are some small motors for stirring operations. There is a strong belief here that all means for saving time should be employed in the work; and that the student should be encouraged to utilize anything that will subscribe to this beneficial end. Where a large number of chemical determinations have to be made in a day, or where, in the chemical control of plant, information is required quickly, the utmost speed is necessary. In such cases labour and time saving methods are often money-saving ones. In this laboratory, twelve students (with the demonstrator) can at one time have abundant accommodation. On the blue-brick piered and stone-covered benches alongside the left-hand side of the room, there are furnaces for conducting the ordinary combustion analysis of coal. Here, as in the other laboratories, all the gas-pipes for supplying the furnaces, bunsen burners, &c., and the water-pipes for supplying the various requirements of the students, are run round the walls and in front of the benches. It is also remarked that the benches are continuous, with channels at the back for conveying away the waste-water to the end sinks. By this method, there is a saving of space—in fact, the arrangements in these laboratories are in every respect the best that experience can suggest for the comfort of the students and for facilitating and expediting the work. At the end of the laboratory, among other apparatus, are a Bone and Wheeler gas analysis apparatus and coal and gas calorimeters, with all the necessary adjuncts. On a facing bench are the appliances for testing the various properties of oil fuel, including the needful apparatus for ascertaining the flash-points and viscosity of oil. From the viscosity, judgment can, for example, be made as to whether the oil will or will not flow through a certain size pipe. These instruments being standard ones, students are familiarized here with those used in Government laboratories, and are afforded facilities for becoming the managers of the chemical control department of any works.

Passing to the side of the room opposite the entrance door, notice is claimed by a battery of steam-heated drying-ovens, the draught through which passes in at the bottom and out at the top; the waste steam being utilized for producing the distilled water required for the laboratories. Down this side of the laboratory, steam is laid, with reducing-valves; and by it water can be heated by means of steam-coils. Over the benches now under inspection is a glazed hood; and any vapour generated during the operations conducted here is drawn through the back flues, as previously described. In addition to gas, water, and steam, air under pressure is also furnished. Along the benches, there is observed, among much else, apparatus for ammoniacal liquor distillations, for the determination of nitrogen in fuels, for pyridine extraction of coals, and for determining benzol in coal gas. Among the furnace equipment were noticed combustion furnaces for the ultimate analyses of coal and fuel oils; and a Carius tube furnace as used for the estimation of chlorine in fuels. Interest was also claimed by the filter washing apparatus devised by Mr. Sinkinson (who is in charge of the work in these laboratories), as well as by an apparatus for the extraction of solutions by liquids, designed by Mr. H. Howlett, B.Sc., a student of the department. A spacious draught chamber brings to notice the fact that there are four of these in this laboratory.

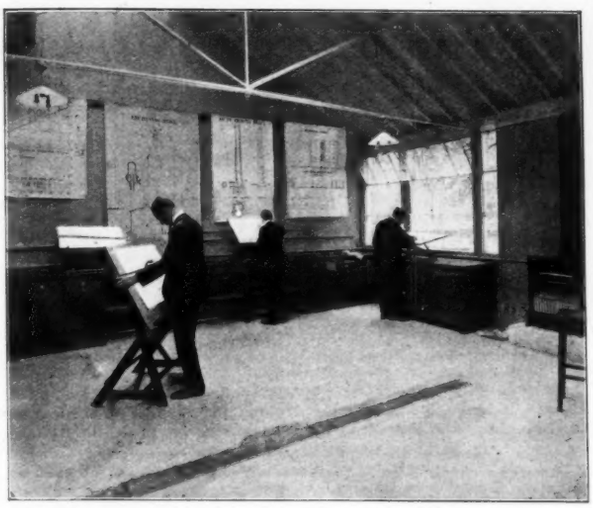
At the end of the laboratory, a balance-room has been partitioned off; and the time of students is saved by being able to pass from their work direct to this room.

The Refractory Materials Laboratory.

Re-entering the Refractory Materials Laboratory, it is found that the equipment has been provided with the idea that the students shall take the raw material just as it comes from the mine, analyze it, refine it, briquette it, fire it, and then test it for its physical properties. A stock of raw material is seen in the closed-in bins. Here is a grinding-mill, driven by an electric-motor; and a neighbour is a pug-mill for mixing the clay, so as to get a good dough. Here, too, is one of Shöne's elutriating apparatus for clays and soils; and an ordinary hand-moulding machine is observed. At one end of the laboratory, is a hooded and furnace-equipped bench. Here the student fires his briquettes; and then there is the Adie machine whereby he tests their tensile strength and mechanical properties. Cupboarded for protection are other instruments for testing heat conductivity and the other thermal properties of the material; and there are the means for testing the power of the material to resist high temperatures or fluxing at high temperatures. In the gas industry, the question of the strength and durability of retorts and other fire-clay goods, and of their heat conductivity, have been prominent ones during the past few years; and certain comparisons were a time ago made of the technical control on the part of fire-clay goods manufacturers in this country and in Germany—not then always to the advantage of those in this country. Into this controversy, Professor Bone declines to enter. But he does admit that in times past he has been very much struck with the thoroughness with which refractory materials are always being tested in Germany; and, when he took the headship of the Department of Fuel and Chemical Technology at the Imperial College, he determined, in view of its importance, that all the students should be given a systematic training in the properties of the various refractory materials for furnaces, gas-retorts and settings, coke-ovens, gas producer and carburetted water-gas plant linings and chequer work. The service that Professor Bone is seeking to perform

in this laboratory is to turn out specialists in the scientific examination of materials and control of the work in the factories producing fire-clay goods (such men will also be of monetary service to large buyers), so that, in this particular, the charge cannot hereafter at any time lie against the manufacturers of this country that their raw and finished materials are not tested with the thoroughness followed by German competitors, and are not of equal merit as to quality. Mr. Walter C. Hancock, who is a specialist in this work, takes the students in hand every Friday morning; but, of course, study and practical investigation work proceed throughout the week.

On one of the benches is an ordinary muffle furnace where the ashing of coals is carried out. It is shortly going to have a companion in a furnace for the high-temperature firing of fire-clay briquettes—a furnace which will allow of testing at a temperature of up to 1400° or 1500° C. On the bench at the opposite side of the room, are other experimental furnaces—one whereby work can



A View in the Chemical Engineering Drawing-Office.

be carried out on quite a laboratory scale to ascertain the amount of coke, tar, ammonia, and gas which can be produced from a coal with coke-ovens. This test has been devised in coke-oven laboratories; and it is found that, by multiplying the laboratory results by a certain factor, determination can with fair approximation be made of what will be done with the same coal in the coke-ovens. Adjoining is a small furnace which works—progressively carbonizing coal from one end of a tube to the other—entirely automatically without any attention; and it saves quite two hours of a man's time. One of the students took large part in the design of this furnace the temperatures of which are electrically and automatically registered. As before remarked, the training given in chemical engineering enables the students to design their own apparatus for work in the particular directions in which they desire to carry on investigations. There are several men in the department who have, under the encouragement given, designed new apparatus.

Among the other equipment here is an experimental tar-still, designed by Mr. Sinkinson. It has been devised so as to follow, on a small scale, ordinary practice in tar distillation. By it some 2 gallons of tar can be distilled at one time. Special features, are that a thermometer can be introduced, and, by a special stirring arrangement, the tar can be kept in motion as the distillation proceeds. The still is also fitted with a steam-coil, so that it can be used as a preheater in the first stage of the work, and so avoid having a separate piece of plant for the purpose. Then there is a perforated tube to introduce live steam (up to 70 lbs. per square inch) when the anthracene oil stage is reached. Thus, by this ingenious apparatus, one can practically follow out all the conditions as found in an average tar-works.

A further piece of apparatus which claims special notice is an experimental frame filter-press which is used for two purposes—one, for carrying out mechanical tests, the other (this is the purpose for which it is chiefly employed) for working-up the tar products. Tar is dealt with in the laboratories from the crude state to finished products—for example, aniline dyes—so that a student is taken from the *alpha* to the *omega* of tar and its derivatives. By the same piece of apparatus, a student can tell the power required for filtering various sludges—in fact, by it a large amount of information can be obtained regarding the process of filtering on the large scale, and some of the constants for filter-presses can be worked out.

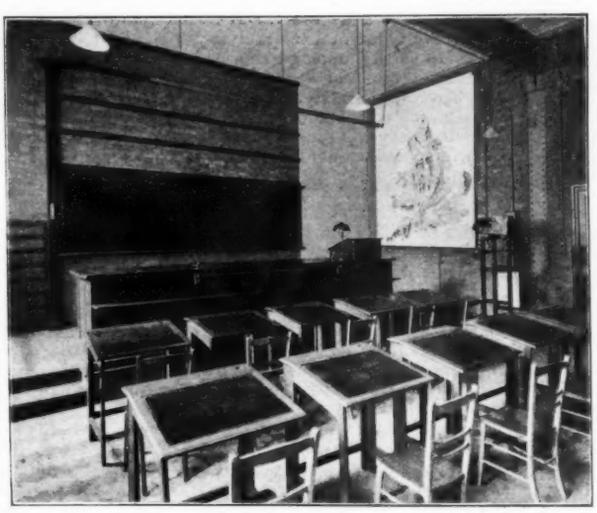
Ordinary crushing and grinding machines for coal are also seen. Gas and water pipes are arranged overhead, with capped outlets ready for making connections; and there are covered gutters in the floor. By their aid, temporary special experimental work can be undertaken in any part of the room, and that quite promptly. Another point to which attention is drawn is that the laboratories are fitted up with electrical pyrometric connections so that temperatures can be recorded on stationary automatic recording machines permanently located in one of the research laboratories on the floor above.

Research Laboratory with Large Plant.

Upstairs, the two principal laboratories, as before pointed out, are in size duplicates of the two laboratories on the ground floor in which so much interest has been found. Going first to the Research Laboratory for Large Plant one soon gets interested in the equipment; and, in the future, we expect a good tale will be told of work done in this department. The first plant that claims attention on entering is a group comprising a gas-compressor and an air-compressor, which will respectively give a supply of gas and air at pressures up to 7 lbs. per square inch. Another member of this group is a Parkinson high-pressure meter, which will register up to 2000 cubic feet per hour at any pressure up to 7 lbs. per square inch; the consumption being automatically corrected to, and registered on the index at, atmospheric pressure. The meter is highly accommodating—not objecting to any variation of pressure during experimental work from 1 inch up to 7 lbs. pressure. The system of pipes and valvular arrangements about this group of plant appears to be somewhat complicated; but this is merely due to the fact that provision has been made to give full liberty in the matter of bye-passing just as required. From this part of the research laboratory, the gas and air are taken by pipes laid in covered channels, and terminating in nozzles at either side of the laboratory.

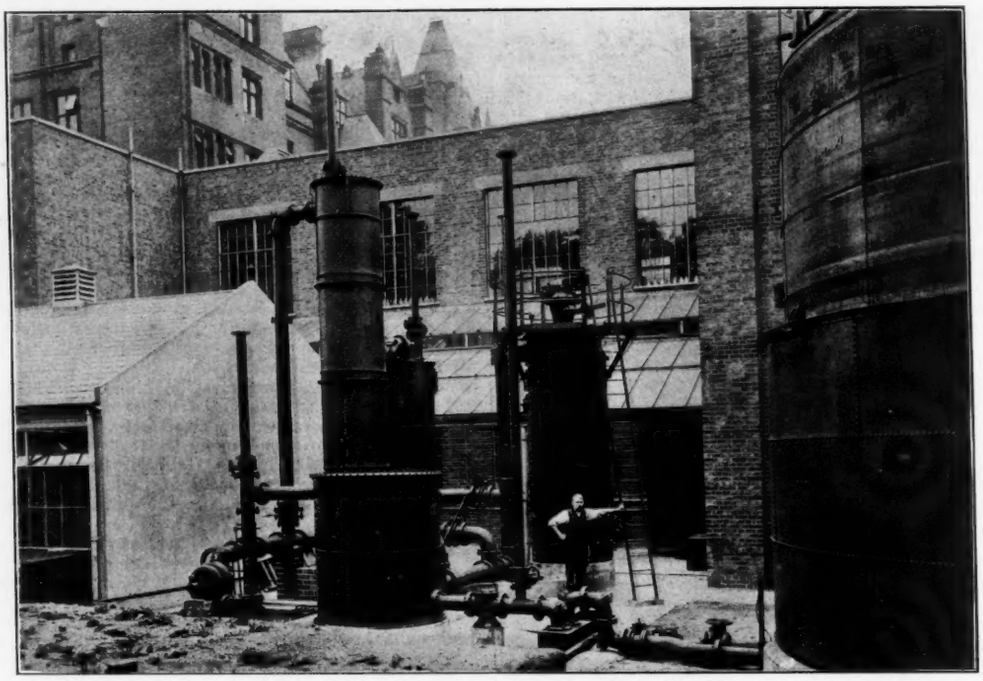
The next piece of plant which arrests attention shows the value of the department's system of chemical engineering training. One of the students—Mr. R. S. G. Knight, B.Sc.—was awarded last July a Carnegie Scholarship by the Iron and Steel Institute for a special study of the heat balances of furnaces. Now he has designed his own experimental furnace, and it stands here, a substantial feature in the equipment. From Mr. Knight's own drawings the fire-brick work was built by Messrs. Morgan and Co., of Battersea; and the framework and all the burners were supplied by Messrs. John Wright and Co. The outstanding feature is that the furnace can be fired and operated with or without regenerator at will. By it various systems of furnace firing can be tested. It can be used either as a muffle furnace, or as a chamber furnace with direct flame; and each system can, if necessary, be combined with regeneration, both gas and air, or gas and air separately. Complete pyrometric control is fitted to the furnace, together with a "CO_2 Recorder" for the flue products, and which recorder finds accommodation upon the adjacent wall.

In the neighbourhood is the recording part of the pyrometric system to which reference was made while dealing with the



The Lecture Hall.

Refractory Materials Laboratory. In this, there have been adopted as thermo-junctions platinum rhodium for temperatures of 1200° C., and silver-constantan couples for temperatures up to 600° C. For temperatures above 1200° C., the Fèry pyrometer (which also works in conjunction with this recorder) has been adopted. This will work up to temperatures of (say) 1800° C. The recorder is connected up, through a box and switch, to any one of ten circuits throughout the building—the leads passing up from the circuits to a board alongside which the recorder is fixed. By the system two temperature records can be automatically made simultaneously. A secondary pyrometric system consists of portable instruments—some of them with thermo-junctions, and some electrical resistance pyrometers. In the Refractory Materials Laboratory, Seger cones are usually employed. Close by is observed one of Mr. A. C. Ionides' appliances for obtaining and maintaining a constant mixture of gas and air, for working in conjunction with one of his furnaces. Along the side of the laboratory opposite the compressing plant first referred to is a plant for



EXPERIMENTAL GAS PRODUCER PLANT, WITH THE THREE THOUSAND CUBIC FEET HOLDER. A PORTION OF THE CHEMICAL ENGINEERING DRAWING-OFFICE IS SEEN ON THE LEFT-HAND SIDE.

compressing gases up to a pressure of 200 atmospheres. Hydrogen, methane, carbon monoxide, or any other gas can be dealt with by this plant, and be distributed in cylinders under pressure round the laboratories. In connection with this plant are separate holders made by Messrs. Clayton, Son, and Co., each of 10 cubic feet capacity; the idea being that the gas—the hydrogen, methane, carbon monoxide, or other gas—can be prepared and stored in these holders, from which the gas can be drawn for compression, and then passed into the cylinders. There are four of these 10-feet holders in the laboratory. We stop for a few minutes to examine the display of apparatus with which, through grants awarded by the Royal Society, Professor Bone carried out a long research during the six years (1906 to 1912) he was at Leeds University, upon gaseous combustion at high pressures, the valuable results of which research were recently communicated to the Royal Society. The apparatus includes a large bomb, fitted with a Petavel recording manometer. On the same side of this laboratory is a hooded bench upon which is seen a Bonecourt surface combustion diaphragm and muffle furnace.

Research Laboratory for Smaller Apparatus—The Prospective Lines of Research.

The adjoining laboratory is being devoted to work with lighter apparatus, and is intended for carrying out scientific researches upon the chemistry and combustion of gas and gas reactions generally. This is the room in which the bolometric method of testing the radiant efficiency of gas-fires was worked out.* Round the room are benches and various appliances; but the more delicate instruments required in this work are kept under lock and key. One course of research which Professor Bone is proposing to prosecute in this laboratory is with the object of getting out data in regard to gases, their combustion, and flame generally. Such information is required by makers of gas appliances, and should be very useful. He hopes (given a sufficiency of men) to systematically commence this work in the coming autumn; and the initial line of investigation will probably be to take certain combustible gases, mixed with various proportions of air, and at different pressures—say, up to 2 atmospheres—and so find the changes in the velocities of flame propagated. Then the point would be to ascertain whether, when two combustible gases are mixed with air, the velocity of flame propagated found from the mixture can be calculated from the known velocities for each gas when separately mixed with air at corresponding temperature and pressure. This is an example of data which are often wanted by manufacturers of gas appliances, burners, and so on. At the present time, there are no complete data available in this particular direction.

Among the apparatus in the department is a Threlfall micro-manometer, for the accurate measurement of differences between the static and dynamic pressures in gas-mains; and elsewhere introduction is made to a recording differential pressure-gauge by the Gas and Mechanical Speciality Company, of Manchester. This is an attempt to do what the Germans did before more successfully than this country had done. The instrument is designed so that the difference of 1½ inches between the dynamic and static sides will produce a rise in the flow of 6 inches; and this rise is marked upon a revolving drum, and is registered on a clock. It is quite a simple instrument; and it has been in satisfactory use at the Skinningrove Iron-Works for the estimation of the heat-balance of a Cowper hot-blast stove.

Seen in this department is a circulation apparatus, as used in the investigations of the influence of hot surfaces upon gaseous combustion. There are also an electrically-heated tube furnace for temperatures up to 1000° C., a Bone and Wheeler gas analysis apparatus, by the same inventors an apparatus for the analysis of mine air and other gases as used at the Home Office experimental station, a Boys gas calorimeter, and a laboratory chronograph for use in determining the velocities of flame propagation through explosive mixtures.

The Gas Plant, and its Value in Research Work.

Left almost to the end for separate treatment is the producer gas plant presented to the department by Mr. Robert Mond, which contributes largely to the wide range of work which is conducted in the laboratories, and is planned for future operations. The plant, which is located outside, is of the producer type supplied by the Power Gas Corporation. The idea of putting down the producer plant is a two-fold one: First of all, it is desired to give the students a systematic training in the management of a gas-producer plant; and, secondly, it is desired that there should be ability to serve the laboratories with gas of any calorific value intermediate between a low-grade producer gas and a high-grade coal gas. The generous presentation of this plant by Mr. Robert Mond permits the fulfilment of these desires. The plant consists of a producer with a Mond type of grate, and an exceptionally deep producer, so that any depth of fuel can be worked, from shallow upwards. From the producer, the gas passes through washing-towers and scrubbers, so arranged with valve control that any one can be bye-passed and any degree of scrubbing be given that is required. Then the gas, after receiving its preliminary scrubbing through the two towers, flows through a tar-extractor (which is really a fan, driven by an electric-motor); and this removes most of the remaining tar. To clear the gas of tar fog, it next passes through a sawdust scrubber. By this time the gas is as nearly tar-free as it can be, and is cooled down to about atmospheric temperature. A rotary meter records the amount of gas passing to a water-seal box away into the holder (in an above-ground steel tank), which has a capacity of 3000 cubic feet.

The gasholder was especially designed by the engineers of the Power Gas Corporation to meet the requirements of the department. The connections are so arranged that the 3000 cubic feet holder can be cut-off from the producer plant, and can be used for producer gas alone, or coal gas alone, or a mixture of the two. A coal-gas main is connected up just before the tar-extractor; the idea of bringing the coal gas in at this point (when a mixture is required) being to obtain a thorough mixing by means of the fan tar-extractor and sawdust scrubber. Thus a gas can be prepared synthetically of any quality intermediate between a producer gas and the coal gas supplied by the Gas Light and Coke Company. This is very useful indeed for research work; and so is the fact that the holder can be filled at the beginning of a week, and experimental work be conducted with the same gas throughout the week—the 3000 cubic feet being quite sufficient for the small experimental work during that period. Of course, town gas is

* A brief description of this method, supplementing that given in the Royal Society paper by Professors Bone and Callendar and Mr. H. James Yates appears on p. 387 of this issue.—Ed. J.G.L.

liable to vary somewhat in composition day by day, and so is the pressure; and for research work constancy of composition and pressure are absolute essentials. With the holder, it is found that a pressure-governing appliance at each furnace can be dispensed with. In the research laboratories, where larger work proceeds, the same accuracy in gas conditions does not matter so much; and in all these cases the supply of gas is drawn direct from the ordinary mains.

Another feature of the coal-gas supply (the arrangements for which were designed and carried out under the supervision of the Gas Light and Coke Company) is that there is a main each side of the building, and therefore two meters; and so the laboratories are fed from both sides. If, therefore, there is a heavy demand on one side of a laboratory, it does not interfere with the service on the other side.

At one corner of the covered space by the producer gas plant there is a 100 cubic feet holder. The intention is to utilize this in connection with work on the heating value of fuel gas, and of synthetic mixtures of fuel gas and ordinary gas, and also on gas-fires. In this holder, too, single gases can be made and stored—such, for instance, as hydrogen and carbon monoxide, which will enable an immense amount of work to be done on the heating values of different gases. This 100 cubic feet holder is connected by a ¾-inch pipe with the laboratories on the upper floor. It will be seen from these particulars that the department is in a position to experiment with coal gas, producer gas, various mixtures of both, or gases containing larger proportions of hydrogen, carbon monoxide, or other gas made in the small holder, or with these latter gases alone. There is no question that in these gas arrangements, and the ability to cover such a wide field of experimental research, the Fuel and Chemical Technology Department of the Imperial College stands unique. There ought to be the opening here to a good expansion of the friendly relations of the department with, and usefulness for, the gas industry.

The Private Laboratory.

Leaving this interesting gas installation, an inspection is made of the private laboratory devoted to Professor Bone's own researches. It is equipped with many beautiful and delicate instruments—at the present time specially for work on the influence of hot surfaces on gaseous combustion, in continuation of the work he was pursuing at the Leeds University. In addition to research gas analysis apparatus designed by Professor Bone himself, there are seen circulation apparatus for use in the investigations just referred to; apparatus for investigating the electrical effects obtained during the absorption of gases by metals; air and molecular pumps (the latter for the production of high vacua); a M'Leod gauge for the measurement of very low pressures (from ½ to 1-10,000 of a millimetre); means for preparing pure electrolytic gas from a solution of barium hydroxide, and for the preparation of hydrogen and oxygen by electrolyzing a solution of barium hydroxide; burettes, tubes, gas-working apparatus, a 15-inch sparking coil and instanter interrupter, and a mercury still.

Research Assistants, Lecturers, and Demonstrators.

While inspecting the private laboratory, Professor Bone mentioned that (in addition to Mr. E. Sinkinson) he has as research assistant Mr. S. Robson, B Sc., with an 1851 Exhibition Scholarship, from the Armstrong College, Newcastle-upon-Tyne. Mr. R. S. G. Knight, B.Sc., with the Carnegie Scholarship of the Iron and Steel Institute, is one of the students. There are three other students (fourth year) working under Government scholarships. There would be several more research students at work; but they have gone to the front, holding commissions. In the work two demonstrators and three special lecturers are attached to the department—Mr. Hinchley for chemical engineering, Mr. Walter C. Hancock for refractory materials, and (although away at the war at present) Dr. M. D. Christie as an associate professor, and a special lecture on coke-oven practice.

In Conclusion.

We must, in conclusion, congratulate Professor Bone and the governing body of the Imperial College on the completeness of the organization of the department, and on the excellence of the laboratories and their equipment. A comfortable and healthy environment has been provided for the students; conveniences and facilities for covering a broad area of work are here; the equipment marks the latest advances in aids to performance, measurement, and accuracy; and the students are encouraged by their training to fit themselves for a large field of usefulness, and in that field to work with assiduity and exactitude, and to be ever on the alert for profitable development. Their training here is not confined to rule. It is also directed to the end of impressing the limitless character of chemical technology, and the great scope there is before them for penetrating the unknown, and for producing from its latent stores further usefulness for mankind.

GEYSERS AND BATH-ROOM AIR.

An Investigation on Carbon Monoxide at Rotterdam.

We learn from a correspondent that a considerable amount of publicity has been given in the Dutch papers to the death of a gentleman in his bath-room, as the result, according to the medical men consulted in the case, of poisoning by carbon monoxide. The water for the bath was supplied through a geyser; and when the unfortunate man was found all the gas-taps were closed and there was no leakage, but the door and window of the room were shut. Three doctors were engaged in the case, and they advised the public to look upon geysers and bath-room stoves as "dangerous" appliances. But they said the danger could be nullified by opening the door or the window during the preparation of the bath, while a proper chimney was necessary to allow of the exit of the products of combustion. Our correspondent mentions incidentally that in Holland there is a tax upon chimneys, and that it increases with the number in use.

The above declaration by the medical men caused great commotion in the gas industry; and a long controversy took place in the papers as to the possibility of the formation of carbon monoxide by a gas-stove when burning. Dr. Terneden, of the Amsterdam Gas-Works, expressed the opinion that the doctors had made a mistake, and that the cause of death was asphyxiation due to the large quantity of carbonic acid formed, for which there was no outlet. To this the doctors retorted that in the case in question no doubt existed, as blood taken from the body of the deceased had the characteristic spectrum given when carbon monoxide is present. For further proof of the soundness of the conclusions they had come to, four mice were put into the bath-room under similar conditions to those obtaining at the time of the accident, and they all died the same day from carbon monoxide poisoning. It would seem, therefore, our correspondent remarks, that, after these tests, it must be acknowledged that there are circumstances in which carbon monoxide is produced in bath-rooms, but that in most cases the resulting ailments are due to carbonic acid.

A great part of the controversy consisted of a discussion of the question of how to effect a speedy exit of the products of combustion without coming into collision with legal requirements; in other words, how the chimney tax could be evaded without rendering the parties liable to punishment. This matter was, of course, of little or no interest to the public at large. To the gas industry the principal question was whether or not carbon monoxide could be produced in a geyser or other hot-water apparatus burning in a closed room of small dimensions; and their answer was that it could not, whereas the medical men said it could.

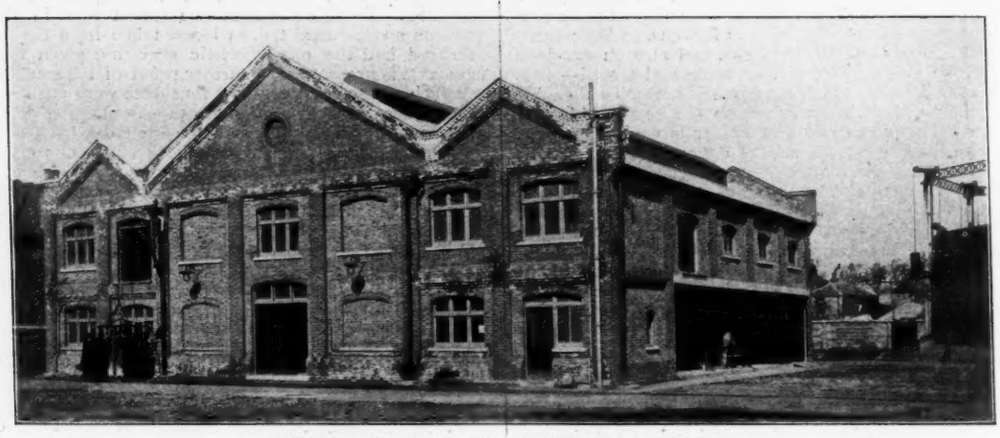
Herr Blom, the Manager of the Haarlem Gas-Works, took up the matter from the practical side, and appointed an independent chemist, not interested in gas, to carry out a series of investigations. He first of all made a test under normal conditions. The geyser having burnt for 20 minutes in an unventilated room, a quantity of the air was drawn through a solution of normal blood, and no traces of carbon monoxide were found. In the succeeding experiment some of the combustion gases were treated in the same manner; the result being that no traces at all of the gas sought were to be discovered. The next experiment was a very rigorous one. With a glass tube a cage was made for a mouse. One end of the tube was connected to an aspirator, and the flow was regulated in such a way that every hour 0·4 cubic foot of the air in the bath-room had to go through the tube. Before entering, the air had to pass two wash-bottles containing caustic potash for the absorption of the carbonic acid. This test commenced when the geyser had burnt for 45 minutes with the door and windows of the room closed. After starting, the gas remained burning for another 45 minutes. By this time the atmosphere in the room was absolutely indescribable. Breathing was impossible, and a match could not be lighted. The gas had remained burning, but the quantity of oxygen was so low that the flames were depositing soot. The mouse was perfectly well, and the blood did not contain even traces of carbon monoxide hæmoglobin. The chemical tests of the air in the room also proved the absence of carbon monoxide. Their conclusion, therefore, is that bath-room stoves burning normally do not throw off carbon monoxide in the combustion gases.

Temperature Changes in Mass Concrete.

The members of the American Society of Civil Engineers have had before them a paper on this subject by Messrs. C. H. Paul and A. B. Mayhew. Its purpose was to place before the Society the results so far obtained of experiments made to determine the changes of temperature in the concrete of the Arrowrock dam, which is being constructed by the United States Reclamation Service near Boise (Idaho), and of which the authors are the Construction and the Principal Engineering Assistant. Among the conclusions already arrived at are the following: (1) Large bodies of concrete deposited rapidly during the summer season develop a temperature of from 90° to 95° Fahr. within a period of thirty days, and maintain nearly this temperature for several months. (2) In the case of concrete 1 foot from an exposed face, there is a daily variation in temperature of about 2° when the daily variation in the temperature of the air is about 50°. (3) In the case of concrete 2 feet from an exposed face, there is a daily variation of less than 1° when the daily variation in the air temperature is about 50°. (4) In the case of concrete 3 ft. 6 in. from an exposed face, no daily variation in temperature is apparent when the daily variation in the air temperature is about 50°. (5) The seasonal variation in the temperature of concrete 3 ft. 6 in. from an exposed face is about 32° when the seasonal variation in the mean daily temperature of the air is about 75°. The experiments have not yet been carried far enough to show the seasonal variation at other distances from exposed faces; but the authors think it is probable that they become very much less as the distance from the face increases.

THE WOOD GREEN ELECTRIC SUPPLY UNDERTAKING OF THE TOTTENHAM DISTRICT LIGHT, HEAT, AND POWER COMPANY.

TOWARDS the end of last year current was first switched into the mains from the fine electricity generating station put down at Wood Green by the Tottenham Light, Heat, and Power Company. At the meeting of the proprietors of the Company in February last, the Chairman (Sir Corbet Woodall, D.Sc.) briefly described the station; and it occurred to us that a more detailed description would be of both interest and service to our engineering readers. In consequence Mr. A. E. Broadberry, the Engineer and Manager of the Company, suggested communication with the Consulting Electrical Engineers, Messrs. May and Hawes. The following descriptive article kindly supplied by the firm, together with the photographs, is the outcome of the communication.—ED. J.G.L.



GENERAL VIEW OF THE GENERATING STATION.

Centre Bay—Engine Room. *Left Bay*—Workshop and Switch-Room, with Battery Room over. *Right Bay*—Check Office and Water Cooler Room, with Tank Room, Stores, and Engineer's Office over. Gasholder at side.

Statutory powers for the supply of electrical energy in Wood Green were conferred upon the District Council by the Wood Green Electric Lighting Order of 1902, and transferred by the Tottenham and Edmonton Gas Act of 1913 to the Tottenham District Light, Heat, and Power Company—the new title given by the Act to the Tottenham and Edmonton Gaslight and Coke Company.

As soon as the Act received the Royal Assent, in August, 1913, the Company instructed their Consulting Electrical Engineers, Messrs. May and Hawes, of Caxton House, Westminster, to proceed to give effect to the scheme which had been prepared for parliamentary purposes; and within a few months constructional operations were started. The progress of the work was somewhat delayed by the builders' strike and the war; but the generating works and mains were ready for the preliminary trials in December, and last Christmas Eve, within sixteen months from the passing of the Act, the supply was officially commenced.

AREA OF SUPPLY.

The area of supply under the Order embraces the whole of the urban district of Wood Green. It has an area of 1625 acres, with a population of 50,000 inhabitants. Wood Green is the shopping centre of a large suburban residential area, its High Road—the old Green Lanes—containing many important business establishments, chief among which is the large stores of Messrs. Edmonds, Denham, and Goyder, Limited. This firm have their own electric generating station—one of the most modern of its kind—equipped with plant of 240 kilowatts capacity, the annual output of which approaches a quarter-of-a-million units. Though the electric supply undertaking has been denied this piece of business, the Company have the satisfaction of supplying the gas by which the generating station is operated. The station, in fact, is a miniature example of the new generating station for the public electric supply undertaking.

SYSTEM OF SUPPLY.

The supply of electricity by the Wood Green undertaking is given on the direct-current three-wire system, at a pressure of 240 volts for lighting and heating purposes and 480 volts for power and special purposes. For small power requirements, where the demand does not exceed 3 kilowatts, the consumers have the privilege of taking the supply at 240 volts.

GENERATING STATION.

The generating station is situated in Ringslade Road, at the rear of the Company's local offices and in close proximity to the depôt of the Metropolitan tramways. Town gas, supplied from the Tottenham works of the Company, furnishes the power by which the generating plant is operated. The gas is delivered through a 12-inch main into a holder which has been erected on the site. This holder, which has a diameter of 40 feet, performs the dual *rôle* of providing a substantial storage of gas and of maintaining it at the required pressure at the engine valves. For the registration of the gas used at the generating station a special meter, of a capacity of 20,000 cubic feet per hour, has been provided in a separate building.

In the public mind a generating station is usually associated with boilers, chimney shafts, banks of coal, heaps of clinker, ashes, and flue dust, and columns of smoke and exhaust steam. The Wood Green generating station is devoid of these interesting, but occasionally objectionable, features. Its operation involves no smoke, no smell, no handling of coal, coke, ashes, or oil fuel, or any process that can be productive of legitimate complaint. It is a practical illustration, in fact, of the simplicity, cleanliness, and inoffensiveness of the town-gas method of generating electrical energy.

BUILDINGS.

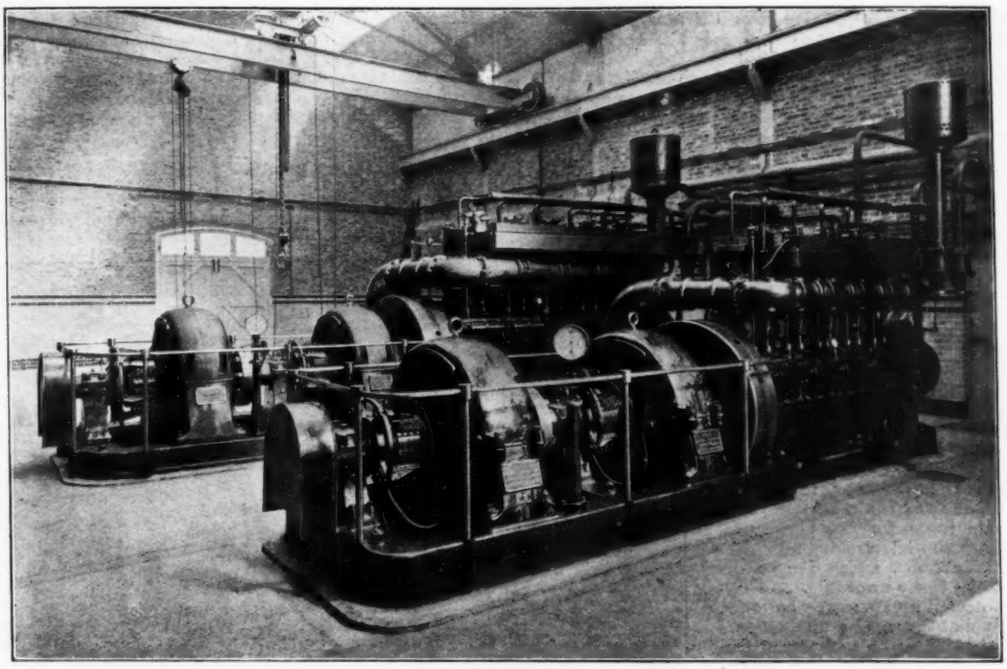
The generating station is a steel structure filled in with brickwork. It comprises three bays; the centre forming the engine-house. The ground floor of one of the side bays provides accommodation for the switchboard and electrical control gear, and for the necessary fitters' workshop, above which the battery room has been constructed. Water cooling plant and silencers occupy the other bay; the water softening plant, storage tank, offices, and stores being situated on the upper floor. Ample space has been allotted for all the plant, and the engine-house has been given a pleasing appearance by a wide dado of glazed green bricks and a neat and serviceable floor of terazzo.

MECHANICAL AND ELECTRICAL EQUIPMENT.

Two sets of generating plant—one of 100 killowatts and the other of 200 kilowatts capacity—have already been erected, and accommodation has been provided in the engine-house for two additional sets of still larger capacity, which are to be erected later on as the demand develops. There is also a battery of accumulators capable of giving 100 kilowatts for three hours, or 200 kilowatts for one hour.

The gas-engines are the modern high-speed vertical type, built by Messrs. Hindley and Sons, of Bourton—one of 170 B.H.P., and the other of 340 B.H.P. The smaller runs at a speed of 450 revolutions per minute, and the larger at 350. Both have five cylinders, and are equipped with forced automatic lubricating arrangements and double magneto ignition.

By means of the multiple cylinders and high speed of rotation, the working parts of the engine are kept comparatively small. As the principal working parts are enclosed and lubricated under pressure, the wear and tear is reduced to a minimum. The engines are extremely compact, require but little attention (being practically automatic in working), and can be started-up and put on full load in less than a minute. There is no noticeable vibration—specially designed foundations having been provided to assure this; and as complete combustion of the gas is effected, there is no risk of any objectionable smell from the exhaust. The silencing of the exhaust, too, has been made almost ideally perfect. The multiple cylinders and high speed of working are,



ENGINE ROOM, SHOWING THE TWO GENERATING SETS AND THE OVERHEAD CRANE.

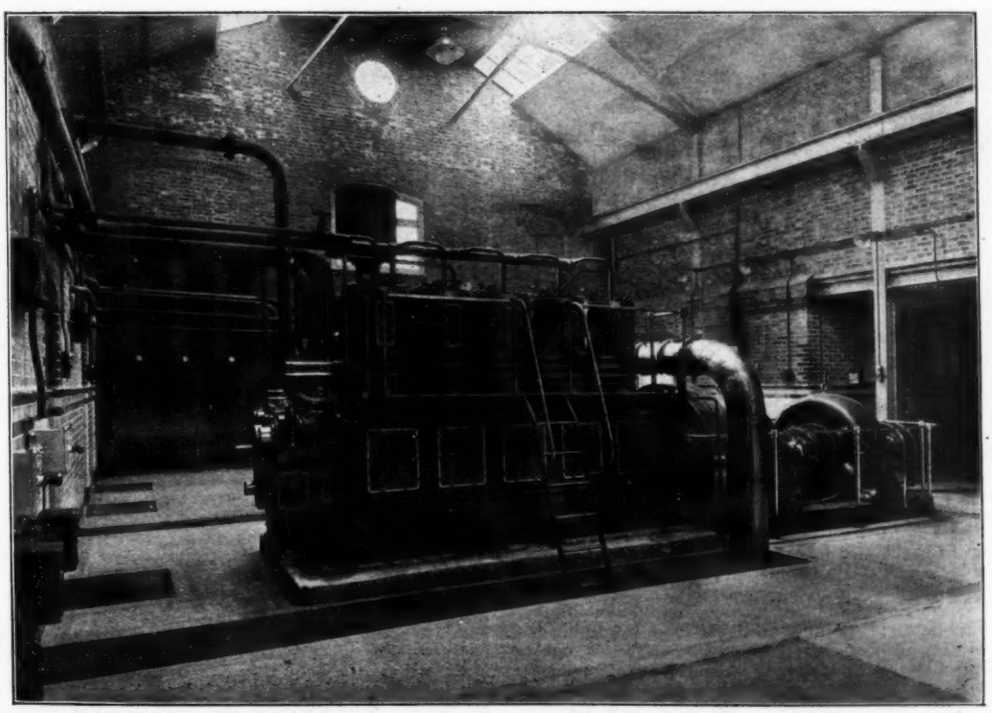
of course, a distinct aid to this attainment; the suction of the gas being practically continuous instead of in periodical gulps, as is the case with the slow-speed single cylinder engine.

Compressed air is used for starting the engines; this being taken from a battery of four receivers which are charged by a motor-driven air compressor. The circulating water for the engines is supplied by gravity from a tank of 1600 gallons capacity situated on the first floor over the cooling plant. By means of interlocking gear between the compressed air valves and the water valves, the starting-up of the engines without first turning on the water is rendered impossible. From the engine jackets the water flows into two "Heenan" rotary water coolers, capable of dealing with 4000 and 2000 gallons of water per hour respectively. The water is returned to the storage tanks by means of electrically driven centrifugal pumps. The make-up water is controlled by a ball-valve on the tank, and all the water used is first treated by a "Boby" water-softening plant of 300 gallons capacity.

The engines are directly coupled to tandem direct current dynamos of the Electric Construction Company's make.

The dynamos are of multipolar shunt-wound type, fitted with interpoles; each pair being mounted on a substantial box baseplate with two pedestal bearings. The armatures of each set have been made strictly interchangeable, even to the provision of a coupling outside the outboard bearing; this coupling being protected by a cover of planished steel. The dynamos are designed to generate current at any voltage from 250 to 280; and even after long periods of running on full load they show very little temperature rise in any part.

The battery, which was supplied and erected by the Chloride Electrical Storage Company, Limited, of Manchester, consists of 270 plantide cells. Each cell has 29 plates, which are suspended from the sides of glass boxes. The latter are supported on pitch-pine stands, insulated from the floor. The battery room is arranged in a single tier, with wide gangways between the different rows, to enable each individual cell to be readily inspected. There is also a gangway across the middle, which divides the two halves of the battery, thereby reducing the danger of shock to a minimum. The whole of the regulating cells range along one side of the room, and the copper rod connections are carried on insulators on the wall to



ENGINE ROOM, SHOWING THE TWO HUNDRED KILOWATT PLANT IN THE FOREGROUND AND THE COMPRESSED AIR PLANT IN THE BACKGROUND.

the centre, where they are carried down through insulating tubes in the floor to the regulating switches, which are immediately below.

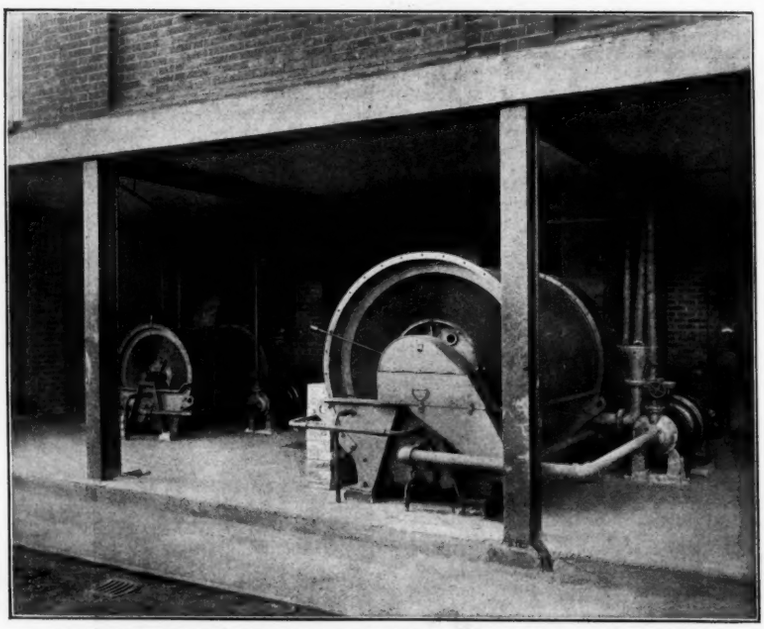
For charging the battery there is a double-ended booster, of the Electric Construction Company's make, placed on one side of the switchboard in the engine-room. The two boosting dynamos each have a capacity of 19 kilowatts, and are driven by a 58 B.H.P. 500-volt motor running at a speed of 1200 revolutions per minute; all three machines being mounted on a combination base-plate. The starting panel is fixed close at hand on the wall, and consists of a double pole ironclad switch fuse and starter fitted with overload and no-volt release, together with an ammeter.

The switchboard, which also came from the Electric Construction Company's works at Wolverhampton, consists of two generators, one battery and booster, one integrating watt-hour meter, and three feeder panels, all of black enamelled slate.

The panels are divided horizontally at the centre by an enamelled slate shield; the top half being devoted entirely to the positive side of the system and the lower half to the negative. The switchboard has an overall length of about 12 feet, and is placed 6 feet away from the wall; thus leaving ample room for the battery regulating switches, and also for access to the back connections, which are so designed as to be easily traceable. All circuits are protected by automatic cut-outs, and, where suitable, time-lag attachments are provided. The whole of the instruments are of the "Cirscale" type, manufactured by the Record Electrical Company, of Manchester.

On the right-hand side of the board three illuminated dial voltmeters are fixed on swing brackets. The top one of these indicates the bus-bar pressure, and the two lower ones are connected to d.p. voltmeter switches, by means of which the pressure at the several feeding points can be ascertained. Paralleling has been made a simple matter by the provision of a portable horizontal pattern voltmeter, which is provided with plugs to fit sockets on the generator and battery panels. On the top of the board there are the battery meters and two pedestal type voltmeters. A pleasing finish is given to the board by an eight-day clock mounted in scrollwork, under which makers nameplate appears.

BATTERY OF ACCUMULATORS, SHOWING THE ARRANGEMENT OF CELLS AND COPPER-ROD CONNECTIONS TO THE REGULATING CELLS.



THE ELECTRICALLY-DRIVEN ROTARY WATER-COOLING PLANT, WITH CENTRIFUGAL PUMPS.

The regulating gear has been kept entirely separate from the board. The resistances are placed in a spacious cellar, situated under the switchboard; and in this cellar the cable connections from the generators and boosters, together with the feeder cables converge. Immediately above the resistances the control pillars, eight in number, including two for the battery regulating switches are mounted on the engine-room floor. By this arrangement it is possible for the switchboard attendant to have control of all the generating plant, and at the same time to be able to see the whole of the switchboard instruments. An earth panel, with an Everett-Edgcumbe disc recording ammeter, short-circuiting relay, and overload breaker, is fixed on the wall at the back of the board.

To facilitate the erection and overhauling of the plant a 10-ton hand-operated travelling crane, made by Messrs. Herbert Morris, Limited, of Loughborough, has been installed on a runway which extends for the whole length of the engine-room.

Gas Consumption of the Generating Plant.

Under the contract the consumption of gas by the generating sets working at ordinary full load, with gas of 500 net B.Th.U. per cubic foot, at normal temperature and barometric pressure, is guaranteed not to exceed the following: For the 200-kilowatt set 30·75 cubic feet, and for the 100-kilowatt set 31·35 cubic feet per unit generated as registered by the watt-hour meters. The official consumption tests have not yet been taken; but it is understood the trials of the plant and their general running on the load give warrant to the view that the guaranteed results will be excelled.

Electric Supply Mains.

Under the Wood Green Electric Lighting Order, the streets scheduled for the compulsory mains were limited to High Road and Myddleton Road. It is scarcely necessary to state that the Company recognized that so restricted a system of mains would be practically and economically unsound, and they were sufficiently enterprising to inaugurate the supply with a comprehensive system of distributing mains throughout the principal streets of the district. Mains will be provided in other streets from time to time as the demand for electricity arises; the feeding and distributing system having been laid out with the view of general extensions.

All the cables are of the three-core type, insulated with impregnated paper, lead covered, and steel armoured. They were made at the cable factory of the Western Electric Company, at Woolwich. There are three feeding centres where the feeder mains serve the distributors—one situated near the Town Hall, one in the High Road adjacent to Noel Park Station, and the other in the Alexandra Park district, near the junction of the Avenue and Alexandra Park Road. At these centres feeder pillars have been erected, and similar pillars in other situations provide an easy means for dividing the network of distributing mains into suitable sections. All the pillars, service boxes, and consumers' fuse-boxes have been made by Messrs. Lucy and Co., of Oxford.

The meters employed for registering the supplies of electric current taken by the consumers, as well as the main meters at the generating station, are by Messrs. Chamberlain and Hookham, of Birmingham.

Contractors.

The firms responsible for the various sections of the work are as follows :—

Gasholder and pipe work	Tottenham District Light, Heat, and Power Company
Buildings, steelwork	Fawcett Construction Company, Limited
Buildings, masons' work	A. Monk
Gas-engines, air compressor, and receivers	E. S. Hindley and Sons
Electric generators, booster, switchboard, motors, and starters	Electric Construction Company, Limited
Electrical testing	Evershed and Vignoles, Limited
Instruments	Nalder Bros., and Thompson, Limited
Battery of accumulators and copper rod connections	Chloride Electrical Storage Company, Limited
Rotary water coolers	Heenan and Froude, Limited
Water-softening plant	William Boby
Over-head travelling crane	Herbert Morris, Limited
Underground cables	Western Electric Company, Limited
Protection boards	Burt, Bolton, and Haywood, Limited
Pillars and boxes	Lucy and Co., Limited
Meters	Chamberlain and Hookham, Limited
Works wiring	Tyler and Freeman

Capital Cost.

The capital expenditure on the scheme, including parliamentary costs, land, generating station, and mains, amounts to about £30,000.

Engineers.

The responsibility for the preparation of the scheme and for carrying it into effect is shared by Mr. A. E. Broadberry, the Engineer and Manager of the Tottenham District Light, Heat, and Power Company, and Messrs. May and Hawes, Consulting Electrical Engineers, of Caxton House, Westminster. The duties of directing and supervising the constructional operations have been performed by Mr. J. Fisher, the Assistant Manager of the Company, and Mr. L. W. Ballard, the Chief Assistant to the Consulting Electrical Engineers. Messrs. May and Hawes, by the way, are the advisers on electrical matters for a number of other gas companies, including the Gas Light and Coke Company, and the Companies at Herne Bay, Jersey, Ilfracombe (Combe Martin), Lurgan, and Enniscorthy.

Charges for Electricity.

The prices charged by the Company for current range from 5d. to 4½d. per unit for lighting purposes, and 2d. to 1d. per unit for power purposes. Meters for registering the supplies are provided and maintained by the Company at a quarterly rental of 2s.

HEATING AN OPEN-HEARTH FURNACE BY TAR.

At the Annual Meeting of the Iron and Steel Institute last week, a note was presented by M. Adolphe Greiner, D.Sc. (the President), on "The Heating of an Open-Hearth Furnace by Means of Tar." The author, as readers may remember, is connected with the great Cockerill works at Seraing, Belgium, and in his unavoidable absence, the chair was occupied by Mr. A. Cooper, of Middlesbrough. The President's note was as follows.

In the month of May last year, when I presented to the members of the Institute a note on the bye-products of modern metallurgy, and dwelt on their actual or prospective utilization,* I was far from foreseeing the unhappy circumstances—such as those from which we are all suffering at the present moment—which would compel the Cockerill Company to face the solution of a fresh problem of this nature. After the total stoppage of the works entailed by the foreign occupation, and once the preliminary period of disorganization had passed, it appeared to us we had a pressing duty before us—that of helping the working-class population around us to the utmost extent of our power to earn its livelihood. For this reason, I decided at once to undertake the manufacture of a portion of the orders we carried on our books, so far as circumstances would allow.

The steel-works were thus compelled to contemplate the necessity of relighting an open-hearth furnace. Our reserves of gas coal had been speedily exhausted; the only battery of coke-ovens which was working was unable to furnish us with gas, of which it was itself in pressing need; the importation of British coal was impossible, and, as a matter of fact, we felt the need of freeing ourselves from the long-established dependence of the works upon foreign countries for a supply of gas coal. There remained, as our sole resource, the tar from the coke-ovens.

I had quoted last year some figures relating to the use of this fuel at the Gary Works in the United States; and that which others had succeeded in doing we likewise wished to do. Indeed, even as far back as last summer, experiments had been undertaken for heating by tar the little 12-ton furnace kept for our experiments, which had already been modified for the purpose of utilizing coke-oven gas. With this furnace the members of the Institute are already familiar. These earlier experiments were carried out by employing injectors of a very rough kind, which were led in, one at each end of the furnace, in the axis of the port of delivery of the coke-oven gas. An arrangement of this description allowed us, in the event of delay or stoppage, to have recourse, without loss of time, to the older form of fuel, which always remained available. Indeed, as a matter of fact, during this experimental period, I am compelled to admit that the inconveniences arising from the use of tar were numerous, and we only succeeded in finishing a few of the charges commenced with this fuel, without being compelled to fall back on the earlier method of heating. So much was this so, that when we found ourselves brought to a standstill for want of the coal which might have been used to feed some other furnace, the problem was a long way from having been solved.

Nevertheless the stimulus of need, added to the satisfaction we promised ourselves at being able to do without foreign coal, decided us to employ this mode of heating. It is not my intention to describe here the details of an installation so often modified, and still less the succession of set-backs which neither rebuffed nor discouraged the Engineer (M. Bourgy) who was in charge of the open-hearth furnace. I will confine myself to saying that not a single charge was lost; on the contrary, experience, even when unhappy, being a fruitful lesson, we arrived by successive modifications at furnishing this experimental furnace with sufficiently reliable appliances which have enabled me to-day to put before you a few figures resulting from practice that has become truly commercial.

These results relate to a campaign of ten weeks' work, from Jan. 10 to March 20, undertaken in the furnace after repairs, and during which, apart from the intervention of Sunday, the only stoppage of work resulted from a delay in the deliveries of fuel—a detail which it is not always possible to control. Owing to various circumstances, the furnace was stopped at the end of ten weeks, after having produced, in 215 charges, a total of 1986 tons of steel of varying composition.

In the present arrangement, the tar is delivered to the sprayers (one only in each burner) with a regular feed and under a uniform pressure of half an atmosphere. It is sprayed by means of air compressed at about three atmospheres. The hot air of combustion is admitted above the injector through the existing port, inclined at an angle of 45°. The average consumption of tar throughout the whole campaign has been 133 kilos. (300 lbs.) per ton of steel, including in this figure the amount required for lighting-up and for heating during stoppages. On the other hand, with an uninterrupted run, this average falls to 115 kilos. (250 lbs.) per ton of steel. The average weight of charges had to be diminished in order to avoid any deflection of the jet of flame issuing from the pulverizer towards the crown of the furnace. Nevertheless, several charges of 15 tons have been worked successfully without any other inconvenience than a proportionately longer working time. The proportion of pig iron found necessary in the charge rose to 28 per cent. After these 215 charges, the furnace is still in an excellent working condition. The roof appears even less damaged than after a similar campaign with coke-oven gas; only the chambers became encrusted. The bricks of the chequer work became covered with a carbonaceous substance, and it will be necessary to devise some means of remedying this inconvenience.

I wish to add that, as a sequel to the satisfactory results we are obtaining, we have built a new furnace of 25 tons capacity, furnished with appliances completely modified for the purpose of the exclusive utilization of tar as a fuel. This new furnace has been in operation since the beginning of April.

The following table affords a comparison of the different results of experiments obtained with the small 12-ton furnace when working, as originally, with producer gas, with coke-oven gas (after a modification of the chambers and of the burners), and finally when using tar, and without any further modification than the addition of the pulverizers:

—	Heated Producer Gas + Hot Air.	Cold Coke-Oven Gas + Hot Air.	Tar + Hot Air.
Produced during campaign	2624 tons	3516 tons	1986·5 tons
Average daily production	39 ,,	48 ,,	38 ,,
Average proportion of pig iron per charge	31 per cent.	21 per cent.	28 per cent.
Average waste	5·5 ,,	4 ,,	4·8 ,,
Fuel consumption per ton of steel	300 kilos. (650 lbs.)	280 cub. met.* (9800 cub. ft.)	115 kilos. (250 lbs.)
Cost of heating per ton of steel†	8·40 francs. (6s. 9d.)	4·20 francs. (3s. 4d.)	4·60 francs (3s. 8d.)

* This figure is difficult to determine accurately.

† This is based on the following: 1 ton of gas coal, including cost of gasification, costs 28 frs. (£1 2s.); 1 cubic metre of coke-oven gas costs 1·5 c. (0·15d.); and 1 ton of tar costs 40 frs. (£1 12s.).

* See "Journal," Vol. CXXVI., p. 422.

No May Meeting of the Manchester District Institution.—The Hon. Secretary (Mr. G. S. Frith) of the Manchester District Institution of Gas Engineers intimates that, owing to the continuance of the war, which is involving extra duties on all gas engineers in the district, the Committee have decided that it is not advisable to hold the usual May meeting this year.

HEATING AND VENTILATING DEVELOPMENTS.

The subject of the future developments of heating and ventilation was brought before the Society of Engineers last Tuesday in a paper read by Mr. A. H. Barker, Wh.Sc., B.Sc. The following is an epitome of the communication, with a report of the discussion to which it gave rise.

At the outset the author expressed surprise, in view of the immense importance to mankind of the twin sciences of heating and ventilation, that the amount of attention hitherto paid to the scientific aspects of these subjects, on the part both of the scientific man and of the engineer, should be so small. He said the subject was hardly seriously regarded as capable of scientific treatment by the average engineer, who probably looked upon it as a branch of plumbing or building, calling for a certain knowledge of rule-of-thumb and a certain amount of practical experience, but scarcely fit for the scientific engineer. Although the science on the subject is still in its infancy, the author expressed his anxiety to secure a more just recognition of its position as a serious branch of engineering. The erroneous view of the science as a mere matter of rule-of-thumb had been fostered in the past by the extraordinarily unscientific manner in which the question had been treated by writers of technical books in America and England. Any educated engineer who studied some of this literature must be driven to the conclusion that there was really no science whatever in the subject. The only legitimate function of the engineer in this connection was to produce and control certain specified conditions. The other half of the problem was for the physiologist and the hygienist—viz., to specify the conditions which will be regarded as healthy and comfortable.

Complicated as the matter was, said the author, it was still more complicated when it was considered that the one object the engineer had in view was to make people comfortable. Here we came across the baffling fact that a man was comfortable when he thought he was. In this connection the author related how he had played the trick upon a medical friend of changing the thermometer in a room without his knowledge, with the result that he was absolutely convinced that the temperature had been increased when it had not. It was an undeniable fact, he said, that a room filled with air which, so far as chemical analysis could detect, was absolutely pure, might feel very stuffy. On the other hand, a room might feel fresh and sweet in which, judged by chemical standards, the air was very bad. He had analyzed air containing 25 volumes of CO_2 per 10,000 volumes of air which felt as fresh as that of a spring morning, though 10 volumes were regarded in current science as the extreme allowable impurity. There must be some combination of chemical or physical conditions which accounted for the effect, so far as it was objective. When it was purely subjective, it was, of course, impossible to analyze the effect. Nobody had, up to the present, ventured to specify what was the combination.

In order to make a systematic beginning of unravelling the tangle of questions which enveloped the problem, the author said it was necessary first to develop experimental means for recognizing and measuring the four different quantities—viz., air temperature, radiant temperature, quantity of convected heat, and quantity of radiant energy. Even before this was done, it was necessary to determine experimentally what was the relation between the thermometer reading, the air temperature, and the radiant temperature. An extended investigation on this point had been made at the University College, and Mr. Barker described his radiant thermometer for separating the air temperature and the radiant temperature, and also his instrument for finding the temperature of air. He also described Dr. Leonard Hill's caleometer, which measures the rate of expenditure of electrical energy required to maintain a coil at the approximate temperature of the body, as well as his large bulb thermometer, which, by noting the rate of fall of temperature, gives a measure of that at which heat is lost from the body.

In relation to ventilating matters, Mr. Barker has developed an instrument which he calls the "pneumatic analogue of the Wheatstone bridge" for the determination of pneumatic resistances. This method has been applied to specify the proper resistance in pneumatic units for a boiler flue and chimney, and by the same means the relative resistance of various types of ventilating gratings and flues of different radii and shape have been found. The author also described the Aitken dust counter.

DISCUSSION.

Dr. Leonard Hill, in opening the discussion, said he had worked with Mr. Barker on the problems connected with the ventilation of the House of Commons. The only criticism he had to make upon the paper was with regard to the author's radiant thermometer. He was inclined to doubt whether this instrument clearly indicated the mean radiant temperature. There was also the question of the emissivity of the walls of the room, and also of the inner wall of the box, to consider. With regard to the physiological conditions of ventilation, the present position of physiologists who had studied the subject was quite clear—*i.e.*, that the whole of the fundamental principles of ventilating and heating depended upon the proper physical conditions of the air, and had nothing whatever to do with its chemical purity. The old idea of chemical purity was entirely exploded.

Mr. F. W. Goodenough congratulated the author upon the excellence of his paper, which he said was much needed, as the subject dealt with was in an extraordinarily backward state. The paper was valuable in that it gave evidence that the difficulties of the problem had never yet been fully appreciated; and he was pleased to see that the author was taking steps to tackle the problem scientifically. In the gas industry they were constantly having it brought to notice how backward was the science, if it could be dignified by that name, of ventilation at the present time. There was scarcely a new building put up in London without at once causing a grumble with regard to its ventilation. An almost classic instance was that of the new Old Bailey; and he had seen several comments in the Electrical Press on the ventilating deficiencies of the building in which they were at that moment discussing the subject [Institution of Electrical Engineers]. In fact, it was a constant repoach that the whole position with regard to ventilation was exceedingly rudimentary. What the architect planned in connection with a building was really speculative, and he was not at all sure how his plans were going to work out. He was pleased if they proved to be satisfactory; but he was not very sure if they were going to be so. Mr. Barker had spoken of engineering as being "glorified common sense;" but he would probably wish to add "and knowledge," because it was knowledge that was missing so much in this connection. The paper did something towards making good the deficiencies, and it also pointed out the directions in which more knowledge was required. The author had rightly dwelt upon the complexity of the problem, and he (the speaker) could assure him that this complexity had been well realized in practice by the gas engineering profession. It was a constant source of trouble and vexation to the industry in dealing with gas-fire problems and chimney draught. There was the great difficulty of constant diversities of weather unless the ventilation was to be dealt with entirely by mechanical means controlled according to external conditions by the human factor. It was the fact, however, that it was necessary to deal with the ventilation of the great mass of rooms in buildings in this country by natural means; and this was a very great trouble, because of changes of weather. There were differences of wind, both in direction and velocity, and of density of temperature, temperature of the outside atmosphere, and internal conditions. There were differences of situations between one hou-e and another—one being in an exposed position at the corner of a street, and another, exactly similarly constructed, in a sheltered position. There were detached and semi-detached houses, and terrace and back-to-back houses; and all the difficulties of them put together were encountered in a block of flats. There was thus an enormous diversity of conditions to deal with; and this was why it seemed to him very difficult to arrive at any rule for the ventilation of buildings. The internal conditions were no less difficult. He had found that the question of chimney draught was complicated in the case of a building where a lift was working. When the lift was going up or down, it produced suction in the chimneys, and upset all the ventilation arrangements, so far as chimneys were concerned. There were also cases in which one chimney pulled against the other. The internal difficulties were scarcely less than the external ones. He congratulated the author on his recognition of the importance of psychology in this problem. Psychology was a word which engineers had rather shied at in the past; they had not sufficiently recognized its importance in commerce. He, however, believed it was a most important factor; and he was glad to see there were some indications of increased attention being given to it. He did not think it had been sufficiently recognized even in the medical profession in the treatment of nervous diseases. The author had given a very striking instance of psychological effect in the case of the doctor who imagined the temperature of a room had gone up when it had not, in fact, done so. In his (the speaker's) business he personally frequently met with instances of this in dealing with Home Office Inspectors, who, if they saw a flueless stove in a room, imagined that the condition of the atmosphere must be bad, even if subsequent tests showed that, as a matter of fact, it had improved. He was also very glad to see emphasis laid on the difference between radiation and convection. The author had mentioned the great difference upon the occupants of a room according to whether the heating was by radiation or by convection, and said there was no recognition of this in the classical literature on the subject. By classical literature he took it that the author meant the science of ventilation and heating. In the literature of the gas industry for the last four or five years—which was very far from being classical, because it was strictly commercial—it would be found that the difference had been fully recognized by the manufacturers and users of gas-heating apparatus. The whole subject had been brought very clearly before the gas industry because of the unsatisfactory results obtained by the old-fashioned gas-fire, which was so constructed as to give a great proportion of its heat in the form of high-temperature convection currents from chambers in the top of the stove through which the products of combustion circulated, and only quite a small proportion of the heat was given off in the form of radiation. The makers of gas-fires had recognized the fact that this form of construction led to the great dislike which many people had for this kind of heating; and he believed the physiological explanation of the dislike people had to what the author had called "apparatus heating," which produced just the same effect as the high-temperature convection currents, was that if the temperature of the air of the room was raised unduly, its capacity for radiant moisture was increased, and also its thirst for moisture. The air then attacked the moist

membranes of the nose and throat, and produced the sensation of dryness which was exceedingly unpleasant. Reference had been made by the author and by Dr. Leonard Hill to the explosion of the old CO_2 bogey, and Mr. Barker had mentioned the case of the air of a room being "springlike" with 25 volumes of CO_2 per 10,000, whereas 10 volumes were usually regarded in current science as being the extreme allowable impurity. It was well known that soda-water makers worked in air with 300 parts of CO_2 per 10,000 without any physiological disadvantage. The problem for physiologists to explain was why the loss of heat from the body by air currents was more pleasant and a more healthful feeling than loss of heat from the body by radiation to other objects of lower temperature in its neighbourhood. He could not himself understand why it should be so; but it obviously was the case. Dr. Hill had often said that the ideal condition was to be in fresh moving cold air in a hot sun; and why this should have the stimulating effect it had upon the body, whereas a similar loss of heat by radiation was unpleasant, he (Mr. Goodenough) did not understand; and he hoped physiologists would explain it.

Mr. W. Nobbs did not altogether agree with the author that the science of heating and ventilation was in quite such a state of chaos as he suggested, nor that engineers did not quite know where they were in regard to these matters. Great strides had been made in the science in recent years, and the old rule-of-thumb methods had been largely departed from, though there were still a good many of them left. Ventilating engineers had, if anything, a more difficult problem than consulting engineers, inasmuch as they did not receive assistance from the architectural profession, which they should do.

Mr. R. Dolby said that much more attention to heating and ventilation had been paid on the Continent and in America than here, probably because of the more severe climatic conditions there. He did not believe that it had anything to do with the relative ability of the foreigner and the Britisher. His experience with hospital work had led him to the view that the ideal was to have air at a lower temperature, and to heat as much as possible by radiant heat. Until recent years it was usual to heat wards by means of two stoves placed in the centre. These had the effect of bringing fresh air in and warming the air—thus giving radiant heat and hot air at the same time. This system, however, had been done away with to a considerable extent, because of the difficulty of heating the beds near the walls; and the best results he had been able to get were by using hot-water radiators at a comparatively low temperature.

Mr. A. E. Munby, as an architect, defended his profession against the charge of lack of co-operation with heating and ventilating engineers. The average ventilating engineer, he said, usually had schemes which meant so much structural alteration that it was impossible to adopt them.

Dr. J. Kerr (Medical Research Officer to the London County Council) said that in all the schools in London where mechanical ventilation had been adopted the results had been a failure, for the reason that the air was heated to a temperature considerably above that of the body. This was like supplying a thirsty man with salt water. The problem was to supply cool air, and keep the body warm by radiant heat.

Mr. J. G. Clark (Gas Light and Coke Company), referring to the psychological aspect of the question, related an instance which came under his notice, of a workshop in which he had to carry out certain experiments. On entering it he found it was very stuffy—in fact, it was abominable—but the workmen seemed to be unconscious of it. The thermometer was registering at least 10° below the truth. He put another thermometer in position, and he believed this had the effect of making the men realize that the high temperature was uncomfortable, because a few days later the men themselves turned off the heating-stove, on the ground that the room was much too hot, notwithstanding that the temperature was exactly the same, within a degree or two, of what it was previously. It was evident, therefore, that the mere fact of seeing the different thermometer reading had caused the men to realize that the air was uncomfortable. The author had not mentioned the relation of dust to the question of ventilation. Dust in air consisted largely of matter which would undergo oxidation at a moderately high temperature, and give rise to products which irritated the nasal organ. As to the origin of dust, some exceedingly interesting figures had been given in reports published in the "Lancet" during the past month or two in regard to the nature of dust in different parts of the country. It was shown that the presence of tarry matter was most serious; and those who had any experience of dust knew that this tarry matter had its origin in the smoke from domestic chimneys. Consequently the use of a method of heating other than burning raw coal would tend to the diminution of the dust trouble, which, in turn, was mixed up with the question of ventilation.

Wales and Monmouthshire District Institution.—A meeting will take place at the Gas Offices, Cardiff, on Thursday afternoon of this week, of the Wales and Monmouthshire District Institution of Gas Engineers and Managers. The chair will be taken by the President (Mr. H. D. Madden, of Cardiff); and the business will include consideration of a paper by Mr. W. C. Jackson, of Neath, entitled "A Few Notes on Gas Sales," which was prepared for the last meeting, and published in the "Journal" for June 9, 1914 [pp. 714-17]. After the meeting, those present will take tea, on the invitation of the Chairman and Directors of the Cardiff Gas Company.

BYE-PRODUCT INDUSTRY IN AMERICA.

Need of Organization.

This subject was dealt with at length by Mr. J. G. O'Neill, of Annapolis (Md.), in "The Gas Age" (New York) for the 1st inst. The following are some of the views expressed by the author.

The interest that the bye-product coke manufacturer is taking at the present time in benzol recovery and the possible working-up of benzol into dyestuffs is particularly pleasing to many of us who have laboured long in the bye-product field. At the outset let me say that the greatest development for American benzol lies in the harmonious working together of all interested, and the building-up of an organization composed of the best experts in the United States for the recovery of benzol, the manufacture of products derived from benzol, and the marketing of these products. Such an organization must be essentially American, giving little heed to foreign processes of benzol recovery, not overdue attention to their methods of manufacturing benzol products, and most attention to their organization of manufacturing and selling forces. For it is to a large extent by efficient organization that Germany has controlled the world trade in dyes; and without this organization we can never hope to build-up an industry capable of standing the severe competition which it will surely meet before it has reached maturity.

The present war has taught us that a nation to be strong must have mineral wealth, manufacturing facilities, and self-supporting agriculture. In our case a great source of strength, both to the nation and to a possible dye industry, is our immense bituminous coal field. At the present time we are open to much criticism for the manner in which we are wasting this natural wealth. It is pointed out to us that we are wasting $100,000,000 worth of bye-products yearly by coking coal in beehive ovens. We are importing enormous quantities of sulphate of ammonia, and even trying to get nitrogen from the air, in order to make our land productive, when for only a fraction of this cost we could get from this same coal, if coked in bye-product ovens, more than sufficient ammonia for all our needs. Millions of gallons of tar are being wasted in the same manner, when it is so badly needed for the improvement of our roads and as a cheap liquid fuel for our oil-burning locomotives and vessels. Over ten times the benzol, toluol, &c., is wasted which give to Germany a yearly income of $100,000,000 when worked-up into manufactured products.

At the present time we are recovering, from bye-product coke-oven gases, light oils or crude benzol at the rate of 8,000,000 gallons a year. Within two weeks, if necessary, this can be increased to a rate of 11,000,000 gallons, which will then equal the total crude benzol that can be produced by Germany. In three months it is possible to increase this production of crude benzol to a rate of 40,000,000 gallons a year by installing benzol-recovery plants in existing bye-product coke-oven plants.

Admitting that our basic conditions for the establishment of a dyestuff industry are sound, it would be well for us to consider briefly the most logical path which we should follow in order firmly to establish a dyestuff industry, and which from its very inception will be enabled to stand the most severe competition. Three stages of development will be necessary—first, recovery of light oil by all our bye-product coke-oven plants, and washing this light oil with sulphuric acid to produce a water-white product; secondly, the fractional distillation of this product to produce pure benzene and pure toluene, and the manufacture from these of bulk chemicals, such as aniline oil, benzoic acid, picric acid, carbolic acid, &c.; thirdly, the manufacture of complicated dyestuffs, such as are largely used in the United States.

In extracting light oils from coke-oven gas, we take from the gas 7 to 8 per cent. of its heat. The loss of this heat is more than offset by the increased efficiency of the ovens when heated by gas free from oils. We are enabled to carry more even and higher heats, the flues are easily kept free from carbon, the coking time is shortened, and the ovens require much less attention.

The average American coal containing 30 per cent. of volatile matter will yield, when coked in bye-product ovens and the gas treated for benzol recovery, 3 gallons of light oil per ton of coal. This oil is composed of practically 60 per cent. of pure benzene, 25 per cent. of toluene, and 15 per cent. of xylenes, naphthalene, cresols, sulphur oils, carbon bisulphide, &c. The cost of recovering this light oil and of converting it into a water-white product should not exceed 2 c. per gallon. This product will be 85 per cent. of the light oil obtained. It corresponds to the "90 per cent. benzol" of commerce, and is produced by washing the first light oil obtained with sulphuric acid and then distilling it. Placing a value of only 12½ c. on the water-white products at the works, it gives a net income of 25 c. per ton of coal coked. The market for this water-white benzol is unlimited.

After becoming skilled in the recovery of benzol, familiar with the methods of handling and purifying it, the next step is the producing of pure benzene and pure toluene by fractional distillation; and the manufacture of carbolic acid, benzoic acid, picric acid, aniline oil, &c., from benzene and toluene. We are to-day producing carbolic acid from benzene at a lower price than that at which we could have bought it from Germany before the war. The chemicals made in this step are "bulk" chemicals, the labour cost is not excessive, and, judging from our own chemical industries, it is a line of work in which we are well skilled. If at the present time all our bye-product coke-oven plants were equipped

with benzol-recovery plants, and if we had the benzol industry developed to this second stage, we should have sufficient picric acid to supply all the warring countries with smokeless powder.

We now come to the final stage, the production of dyestuffs—the step that is going to test our skill as organizers. We say that a chain is no stronger than its weakest link; so also of a nation. Its strength is dependent upon its army, navy, resources, and its ability to solve problems just such as this one. It would be a great task at the present time to lay successful plans for the conquering of this third step. We must grow up to it, organize for it, and gather strength as each difficulty is overcome. The future, with new conditions, new hopes, new avenues of trade, is opening before us. We cannot stand still; we must advance or retreat. To hold this chemical industry dormant means that we shall retrograde in all our chemical industries, and, above all, it will mean the placing of the seal of approval on the old wasteful beehive oven—a national disgrace.

LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.

Annual General Meeting.

The Annual General Meeting was held on Friday last at the Westminster Technical Institute—the PRESIDENT (Mr. J. Hewett) in the chair.

ELECTION OF OFFICERS.

The balance-sheet was adopted; and the following were elected as Officers and Council for 1915-16.

President.—Mr. S. B. Chandler (South Suburban Gas Company).
Senior Vice-President.—Mr. F. J. Pearce (North Middlesex Gas Company).
Junior Vice-President.—Mr. W. A. Vanner (Walton and Weybridge Gas Company).
Council.—Messrs. F. C. Briggs, W. E. Brown, G. F. Cox, D. C. Cross, A. R. Griggs, E. G. Stewart, W. L. Westbrook.
Hon. Secretary.—Mr. G. Winslow (Gas Light and Coke Company).
Hon. Treasurer.—Mr. F. G. Frost (South Metropolitan Gas Company).
Hon. Auditor.—Mr. E. G. Merry (Gas Light and Coke Company).

WORK OF THE SESSION.

The PRESIDENT, in some remarks to the members, referred to the war and the number of members of the Association who had joined the Colours. During the session, interesting and instructive visits had been paid to the works of several gas companies, and also to those of manufacturers. They are especially indebted to the heads of the various undertakings who had, during a time of exceptional strain and anxiety, allowed them to inspect their works, and had, in so doing, contributed to the further education of the members. It was with regret that the Council, after due consideration, felt obliged to abandon some of the usual functions. The annual dinner, which, in ordinary circumstances, would have taken place some time in March, was felt to be not in keeping with the serious state of national affairs, and it was thought that the members would generally support this view. The summer meeting had been cancelled, for reasons which were undoubtedly sound. Looking back upon the period covered by his occupation of the chair, he thought that, in the circumstances, the session had been a most successful one. The attendances at the meetings had been well maintained; and they had been favoured with addresses and papers of a high order. The visits had in every case been thoroughly appreciated; and the opportunities for mutual intercourse between members which these several functions have afforded had no doubt added largely to the benefits which accrued from membership of such Associations. Referring to the falling-off in the number of members compared with the end of last session, although this was in one way a matter for regret, they had to bear in mind the troublous times through which they were passing. It had been the privilege of some of the members to be selected to act in the capacity of Examiners in the recent examinations in "Gas-Fitting." This acknowledgment of the practical use of their Association was very gratifying, and would not pass unheeded. From a financial point of view the session had terminated successfully. The balance was still on the right side, and although they were unable to add to the trust fund this year, they hoped, by strict economy, to increase this sum in future sessions. Several members had during the session been promoted to positions further advanced in the industry.

VOTES OF THANKS.

The Officers and Council were thanked for their services.

Mr. W. L. WESTBROOK then proposed: "That this annual general meeting of the London and Southern District Junior Gas Association desires to acknowledge and place on record its appreciation of Mr. J. Hewett's services in conducting the affairs of the Association as President during the session now closing, which, with the energy and enthusiasm he has displayed at all times, have materially furthered the usefulness of the Association, especially in view of the serious state of affairs owing to the war in which the country is now engaged, and the members desire to tender their best and sincere thanks."

Mr. D. J. WINSLOW seconded, supported by Mr. R. A. BRIGGS, and the meeting decided that the resolution should be suitably emblazoned and framed, and presented to the retiring President.

Mr. HEWETT thanked the meeting.

Mr. L. W. WORTH proposed, and Mr. F. A. FROST seconded, that a special vote of thanks be accorded to Mr. A. R. Griggs for his services during the session as Hon. Secretary, tendering to him their sincere thanks for the energy displayed and time given in the interests of the Association, and that such appreciation be suitably recorded and presented to him at an early date.

Mr. GRIGGS, in thanking the meeting, said that it was with great regret that he had to resign the post of Hon. Secretary, but he found that, in the present circumstances, he was quite unable to give the necessary time which such a position required.

Mr. D. J. WINSLOW proposed, and Mr. PEARCE seconded, a vote of thanks to the Hon. Treasurer, to which Mr. FROST replied.

THE NEW PRESIDENT.

The new PRESIDENT (Mr. S. B. Chandler) then took the chair; and in a few remarks, in the course of which he congratulated the late President on the able manner in which he had occupied the chair during the session, he referred to the assistance rendered the Association by makers and engineers in giving facilities for visits to their works in the present difficult circumstances, and expressed his thanks for the confidence accorded him by electing him as President of the Association.

The meeting then terminated.

EXHAUST STEAM FOR MAKING WATER GAS.

One of the papers prepared for the last meeting of the Illinois Gas Association was on the subject of the possible economies to be effected by the use of exhaust steam in connection with a water-gas plant. The authors were Messrs. S. A. REINHARD and C. A. SCHNERR; and the following is the portion of their communication dealing specially with this matter.

Probably the most economical, and certainly the most interesting, application of exhaust steam is its use in making water gas. The substitution of exhaust for live steam in gas generators has been talked about for many years, but only lately has it met with success worth mentioning. In all the early experiments, wet exhaust steam direct from the engines was used, and the entrained moisture caused no end of trouble. Various methods of removing the free water were tried, including tapping systems and separators of all styles. Though most of the free water was removed in this way, that in suspension remained. The bottom of a generator is a poor heat retainer at its best, and with a fire partly clinkered, it exerts a decided chilling effect on steam admitted to it. Consequently, if the entering steam is wet to start with, and is then still further chilled, a large portion of it will condense and stay in the generator instead of going through the fire. This water keeps accumulating, and helps to condense more steam, and the generator bottom is continually wet and soggy. This naturally causes a loss in efficiency in the machine. On down-runs this cooling effect is carried by the gas to the carburettor, the chequer-brick is cooled, the fire is in poor condition, and the whole machine sustains a loss in heat that could be avoided if dry steam were used. This heat must be replaced during the time of blasting; consequently longer blows are required, which means increased fuel consumption.

The exact amount of loss in efficiency due to wet steam will be shown later, and very little economy can be gained by using wet exhaust in place of live steam. The make per square foot is reduced, the fixed carbon is increased, and there is a slight saving in boiler fuel, but not enough to overcome the loss in the generators. However, the idea of utilizing exhaust steam in this way was not abandoned. The cause of the failure was evident from the condition of the machines after a short run on exhaust steam; and it was decided to try getting rid of the water in the steam—in other words, raising the temperature of the exhaust well above the saturation-point. A superheater of suitable dimensions was installed capable of superheating the steam several hundred degrees. It was fired by hand, and the fuel used was mostly refuse coke from the generators. The results showed very marked improvement, not only in boiler fuel, but the machines made more gas and of a better quality than with live steam. A slight saving was also noticed in the generator fuel, due to the increased make per square foot. In the first experiments the temperature was raised to about 300° Fahr., or approximately the same as that of live steam. It was afterwards increased to about 450° Fahr., which seems to give the most uniform results. Not much improvement can be noticed by carrying it higher.

These experiments were made in a small plant near Chicago. Two small machines were equipped, and the piping, &c., was made as simple as possible. After getting such encouraging results, one of the large plants in the city, with six 12-feet Williamson machines, was completely equipped for exhaust steam. There are four large exhausters for pumping gas for street pressure, two works exhausters, individual turbo-blowers on each machine, besides pumps and smaller miscellaneous engines. In 1913 two more plants were fully equipped for exhaust steam, one having Williamson machines, the other ten three-shell machines. In all these installations the saving was immediate and marked. The drop in steam consumption for the plant was decided in every

case. Where it took approximately 1200 boiler horse power for a make of 12 million cubic feet of gas per day, using live steam, it now requires only 900 H.P. Exhaustive tests have been made at all these plants to determine just what economy is obtained. The item that shows the saving directly due to exhaust steam is the pounds of steam used per 1000 cubic feet of gas made, which includes all the steam employed in the plant. According to the latest data at hand, this steam consumption was reduced from 100 lbs. to approximately 70 lbs. per 1000 cubic feet—a saving of about 30 per cent., which, with an average daily make of 10 million cubic feet, would amount to $25 or $30 per day, not allowing for depreciation on the installation or the cost of superheating the exhaust steam, which will be discussed later. The final efficiency will figure-out much higher than if the steam were utilized in a low-pressure steam-turbine.

Assuming a plant in which 800 boiler horse power is generated, there will be 24,000 lbs. of steam, which after being used in the engines, pumps, &c., escapes as exhaust. Deducting 10 per cent. for moisture after the steam leaves the engines, and 15 per cent. for feed-water heating, there would be left 18,000 lbs. available for use. If this plant is making 500,000 cubic feet of gas per hour, the steam required per 1000 cubic feet being about 28 lbs., 14,000 lbs. of the available exhaust steam would be used, while only 4000 lbs. would escape to the atmosphere. In this case the thermal efficiency would be 77 per cent.—almost equal to that of a feed-water heater. In actual practice, however, it would hardly be so high as this, on account of the irregularity of the blasting and running time of the machines. If, with four generators running, two could always be on blast and the other two on run, the efficiency might be maintained. But this is almost impossible, and consequently at one time there may be a large volume of steam wasted to the atmosphere, while a few minutes later the steam may be insufficient, and live steam may have to be admitted to the exhaust system to bridge-over.

An Installation of Plant.

The authors gave an illustrated description of an installation of plant for utilizing exhaust steam. All the steam from the engines, turbines, pumps, &c., is gathered into a common header which leads to the inlet of the superheater, the size of the inlet being 20 inches. At two points, preferably some distance from the superheater, 18 inches back-pressure atmospheric valves are installed, with exhaust heads leading to the air. They are kept away from the superheater, to avoid unnecessary fluctuations in pressure near the superheater, because the auxiliary live steam admission valve is very sensitive to any sudden changes in pressure. The back-pressure valves are usually set at about 3½ lbs. The reason for having two of them is that in case one fails to work, or is out of commission for repairs, the other can keep the pressure from "building-up" on the engines. On the inlet drum of the superheater is installed another valve, which blows at a pressure slightly higher than that of the back-pressure valves. At all the low points in the system, traps should be installed to dispose of the free water, and they should be regularly inspected and blown out so that they work at all times. Near the inlet of the superheater an oil and water separator should be placed, to take out the oil and whatever water is left in the steam.

The superheater is of the Foster type, and is capable of superheating 33,000 lbs. of steam per hour to a temperature of 477° Fahr., at 5 lbs. maximum pressure. These superheaters are made of any desired capacity, and with the grates for solid fuel or with tar-burners. The latter type of firing seems to be the most economical. A tar-burner with a steam-jet is a simple affair, and requires very little attention. Occasional adjustment of the tar and steam valves is all that is necessary; and this can easily be added to the duties of the boiler fireman. Drip oil has been tried in this type of burner, and is more efficient than tar. It is almost impossible to make smoke with drip oil, and its heating value is considerably higher than that of tar. The quantity necessary is about 0·04 gallon per 1000 cubic feet of gas. The superheater is composed of horizontal headers with vertical elements connecting them. The steam enters at the bottom and leaves on the opposite side at the top.

In the outlet-pipe from the superheater is a recording thermometer reading to 700° Fahr., which makes a record of the temperature of the steam leaving the superheater; and the fireman governs his firing accordingly. Under good running conditions, the tar or oil burner should not need adjusting more than three or four times an hour. With proper care in firing, no repairs on the superheater should be necessary for years, other than the occasional renewing of the chequer brick in the fire-box. A steam flue blower with a rubber hose attachment for blowing the dust from the tubes is used for cleaning. The outlet-pipe from the superheater is the same size as the inlet (20 inches) and extends to the generator-house basement; it should have at least one expansion joint. The 8-inch branches leading to the 12-feet gas-generators are taken from this 20-inch header, and have quick-opening gate-valves operated hydraulically for both the up and down runs.

All the piping from the outlet of the superheater to the shell of the machine should be well covered with good double-thick magnesia pipe-covering to ensure minimum drop in the temperature of the steam after it leaves the superheater. Likewise all the exhaust piping from the various parts of the plant to the superheater should be properly lagged. At the end of the header leading into the generator house, and at intermediate points, pipes should be placed to drain off any condensation that may form while the system is shut down or while it is being put into operation. After the piping is heated up, not a drop will be found at the drains.

Regulation of Pressure.

The pressure in the bottom of a gas-generator probably never exceeds 54 inches of water during a run. If the pressure in the exhaust system drops below 2 lbs., some provision should be made whereby it can be boosted temporarily until the excessive drain is taken off the system. The emergency can be met economically by an auxiliary live-steam valve on the exhaust inlet-pipe to the superheater. This valve reduces the steam from boiler pressure to 2 lbs. gauge pressure, and must be very sensitive and reliable under all conditions. It should be wide open at 2 lbs. pressure and shut at 2½ lbs. It should be large enough to meet the maximum demand for load, and should never let the pressure in the exhaust system drop below 2 lbs.

It is well known that there are times, in even the best-regulated plants, when it is next to impossible for the fireman to keep his boilers from blowing-off. He often throws open the furnace doors, allowing an excess of air to go through the boiler and thus check the rise in pressure, not realizing the consequent loss in efficiency. It would be a very simple matter to allow this excess steam to blow into the exhaust system, and utilize it, instead of blowing it into the atmosphere. A spring-loaded valve could be installed connecting the boiler header with the exhaust line, set to blow at (say) 2 lbs. or even 3 lbs. below the safety-valves, and an automatic alarm attached to it to draw the fireman's attention to the fact that it was blowing. The chances are that the steam would be needed in the exhaust system just at that time, for high boiler pressure is almost always accompanied by low pressure in the exhaust system.

Measurement of the Exhaust Steam.

The measurement of the amount of exhaust going into the generators has been a difficult problem because of the low pressure of the steam. The common methods of measuring live steam cannot be used for exhaust steam. When three or four machines are running, the fluctuation in pressure is so great that any method based on a constant inlet pressure is almost useless. Pressure-gauges on the top and bottom of the generator, though useful in a way, do not give any idea of the quantity of steam going through the machine. The pressure depends on the number of machines on a run, because the more gas that is being made the greater is the back-pressure all through the machine. The only pressure that does remain constant under these conditions is the differential between the seal or cross pipe and the generator. This is not entirely reliable either, because it rises when the oil is on. However, it is a very simple method, and is being used to good advantage; the gas-maker being instructed to keep a constant pressure while his oil is on, and to disregard it when the oil is shut off. An objection that might be made to running by the differential pressure is that when the chequer brick has been in the machine a long time the loss in pressure through the machine is greater, and less steam passes through it for the same differential. However, this is as it should be, because if the chequer brick is carboned the machine is not in a condition to make as much gas, and consequently should take less steam. The pitot tube principle is probably the most reliable one for measuring exhaust steam.

Results of Tests.

In all the low-pressure steam installations for making gas, comprehensive tests have been carried out to determine the improvement in operating results that could be credited to the use of exhaust steam. Only a few have been selected. Table I. gives comparative results of tests with live steam, saturated exhaust, and superheated exhaust; Table II. shows results on four 12-feet machines, using live steam and superheated exhaust; Table III. gives results of a test made in December, 1914, on four 12-feet machines.

Table I.

	Live Steam.	Saturated Exhaust.	Superheated Exhaust.
Gas made per square foot of grate surface, cubic feet	38,300	35,850	50,100
Carbon per 1000 cubic feet of gas, pounds	26·69	27·49	26·04
Boiler fuel, do., including superheater fuel, pounds	25·46	23·90	20·62

Table II.

	Live Steam.	Superheated Exhaust.
Gas made per square foot of grate surface, cubic feet	38,150	47,403
Carbon per 1000 cubic feet of gas, pounds	28·02	27·06
Water used in boilers, do., pounds	130·50	86·40
Boiler fuel, including superheater fuel, do., pounds	21·05	13·88

Table III.

	Live Steam.	Superheated Exhaust.
Gas made per 24 hours on four 12-feet machines, cubic feet	10,954	11,807
Carbon per 1000 cubic feet of gas, pounds	28·37	27·09
Boiler fuel, including superheater fuel, do., pounds	13·56	9·67
Water used in boilers, do., pounds	97·50	70·00

These tests show the steam used per 1000 cubic feet of gas made reduced between 25 and 35 per cent., or approximately the

whole of the live steam necessary for gas making is saved. In every case one, and in some cases two, boilers less are needed for the same number of machines. The saving in wear and tear on the boilers can also be credited to exhaust steam. The boiler-room labour needed is reduced, as 25 per cent. less coal is used. In every case the quantity of gas made increased considerably, due to the better quality of steam. The exhaust steam, being absolutely dry, reaches the generator in most efficient form, and its cooling effect on the generator and the fire is reduced to a minimum. The pyrometer temperatures drop less, and consequently the blasting-time can be reduced, which means increased running-time and larger make. On account of the shorter blasting-time, the generator fuel is reduced per 1000 cubic feet of gas, and likewise the amount of air blast necessary. The machine, as a whole, seems to be in better condition when operated with superheated exhaust steam, and naturally the results obtained are better.

The question of installing a superheater depends largely on the difference in cost between boiler fuel and generator fuel. Where the latter costs from three to four times as much as the former, the investment pays; and even where the two fuels are more nearly alike in price, it seems advisable to instal a superheater because of the increased efficiency obtained. The use of exhaust steam for gas making is still in its infancy; this phase of the gas business having been developing for a comparatively short time, and confined to the larger plants. It can safely be asserted, however, that in the next few years the field for the use of exhaust steam will widen, and even greater developments can be expected than those which have taken place during the last few years.

COKING AND BYE-PRODUCTS.

By "Event and Comment."

The Fixation of Atmospheric Nitrogen.

Since the days of Priestley the problem of the fixation of atmospheric nitrogen has attracted the attention of chemists throughout the world. The problem presents features not only of a commercial or economic nature, but it is also interesting from the more strictly academic point of view. The ever-increasing demand for artificial nitrogenous fertilizers, such as nitrates, ammonium sulphate, &c., has brought about a corresponding commercial interest in these products. It is, in general, a realization of the fact which has made modern dyeing what it is—*i.e.*, that almost any natural product can be supplanted by a synthetic product of equal if not greater value. A fuller investigation of this fact must necessarily result in a tremendous development in bye-product coking and allied industries, and more particularly will result in the abolition of beehive coking. Largely on account of active propaganda work, the value of artificial manures, and particularly of sulphate of ammonia, has been brought home to farmers in every country; and the production of this commodity has increased enormously during the last ten years. Nitrogen is of value either as ammonium compounds or as nitrates; so there are two distinct openings for the establishment of methods for the fixation of this gas from the atmosphere. The application of electricity in this connection has been a very important factor in the development; but the *sine quâ non* is cheap current, which unfortunately is not yet available to any extent in this country. Much could undoubtedly be done in Great Britain if some progressive firm could see their way to set apart a considerable sum for the purpose of encouraging research in this connection. Synthetic ammonia manufacture is now firmly established on a commercial basis in Germany, and that it will develop is beyond question. After the war, we must be fully prepared to meet unscrupulous German competition in all quarters, not only in home, but also in foreign markets. The manufacture of nitric acid from the atmosphere is also an accomplished fact. Most chemical reactions are reversible, provided that proper conditions can be obtained. Nitrogen and hydrogen can be made to combine by electrical means to form ammonia. Unfortunately, the ammonia is decomposed as soon as it is formed. What is wanted therefore are such conditions that the ammonia produced can be removed from the sphere of action almost as soon as it is formed. This is the problem; and it dare not be said that it is beyond solution. Nitrogen in unlimited supplies is available. Liquid air is now comparatively cheap to produce; and from it fairly pure nitrogen is easily obtained. Hydrogen also is not difficult to manufacture. So that from the point of view of supply of raw materials the circumstances are very favourable. Apart from electrolytic methods, there is the possibility of developing the manufacture of nitrides, which when decomposed by water will yield ammonia.

Present Position of the Bye-Product Coking Industry.

The coke-oven industry in many respects is in a comparatively happy position at the present time; but many contradictory influences are at work which together tend to make the outlook for the future very uncertain. Colliery owners who also have the bye-product coke-ovens are, however, in something of a quandary, and many factors have to be taken into account in coming to a decision. Owing partly to reduced output at the pits, and also to other causes, coal of all descriptions is bringing a high price; and it is in some instances an open question as to whether it is better to sell all the coal or to make a portion of it into coke. In some cases in the writer's knowledge long contracts have been made for the disposal of the coke at a figure at least 10s. a ton below what could be obtained for it at present. This can only be put down to poor business foresight; but the loss entailed to the collieries concerned runs into several thousands of pounds every month. Slack is very difficult to obtain, and there is an eager demand in all districts for any class of rough coal suitable for coking purposes. On account of the shortage of slack, makers are finding great difficulty in keeping the ovens going. The standing charges of a battery of ovens temporarily shut-down are very heavy, as either the heat must be kept up by fires or the brickwork suffers when cooling down. Interest upon capital alone is a considerable item. On the other hand, the present price of coke is such that makers are prepared to pay a good price for coking coal. Then comes in the question of the bye-products. Here the position is more difficult. Sulphate is fetching a good price, and there is a fair demand for it. As pointed out in these notes a fortnight ago, the supply of sulphuric acid is the problem. Acid is difficult to get under any conditions, and supplies cannot be guaranteed for any considerable period except at a very high figure. To take the risk means being faced with the possibility of losing the whole of the ammonia produced, owing to scarcity of acid. Benzol is selling only fairly well; and this is a position difficult to comprehend. Crude benzol contains a fair proportion of toluol, the demand for which is very strong just now on account of its use by explosive manufacturers. Unfortunately, however, coke-oven people are not getting much benefit out of this. In many cases, the make is contracted for for long periods, and, on the other hand, the producers are absolutely in the hands of those firms who buy crude benzol for refining purposes. In this connection, it is difficult to understand why more coke-oven people do not themselves go in for benzol rectification plant and make motor benzol, 90 per cent. toluol, solvent naphtha, &c., &c. The plant is not costly, and it is exceedingly simple to operate, while the main product—motor benzol—can be sold direct to consumers at much better prices than can be obtained from the large dealers. Until about two years ago there were only very few rectifying plants in the country; but the agitation in favour of the employment of benzol for motor purposes stimulated the erection of this class of plant. Rectifying plant for existing crude benzol plants can be erected in a very short time; and it is certainly to the advantage of coke-oven people to look into the matter.

Tar is still the principal difficulty in the bye-products. There must now be an enormous stock of pitch in this country, and the monetary value of it is lost to the producers of the tar for the time being; as, naturally, distillers will only pay for it as they themselves can dispose of it. The opening of the tar-spraying season should, however, ease matters somewhat; and here lies an opportunity for producers to market their own product. In many cases tar-spraying would be much more extensively carried out in certain localities if a supply of prepared tar were available on the spot. Pumping the tar into barrels, transport charges, and discharging add very considerably to the cost to the user. A plant for manufacturing prepared tar—the commoner term dehydrated tar is a misnomer—is of a fairly simple character, and with a little extension can be arranged for the complete distillation of tar. In the latter process the usual fractions taken are: (1) Water and crude naphtha; (2) light oil; (3) carbolic oil; (4) creosote; (5) pitch. For the manufacture of tar for road-spraying it is desirable that no phenols should be left in the tar; and this means the removal of the first three fractions. If such plant is erected —and more particularly under present circumstances—plant for the recovery of crude carbolic acid should certainly be included. Carbolic acid is the basis for the manufacture of picric acid, which, of course, is in great demand at present. Here, again, very simple processes only are involved, and the requisite plant, also, is not expensive to erect. One hopes to see, therefore, considerable development in the near future in the bye-products side of the coking industry.

Electrically Removing Tar from Gas.

Mr. F. W. Steere, of Detroit (Mich.), has taken out three patents for the United States, as Assignor to the Semet-Solvay Company, for removing tar or tarry substances from gas. The specifications are abstrated in the current number of the "Journal of the Society of Chemical Industry." According to the first patent, the gas is passed through an electrical field of alternating polarity, between receiving and discharging electrodes, and is subjected to the action of brush electric discharges from the discharging electrode, which has a pointed surface. The tarry particles coalesce, and are deposited on the receiving electrode. By the second patent, the particles of tar are agglomerated as just described, and are subsequently separated; the gas being passed at such a high velocity that the particles are removed from the electric field with the gas. In the third case the gas is heated sufficiently to liquefy the tar and raise the gas above its water-vapour saturation temperature, and is then passed through an electric field of alternating polarity between opposed electrodes. According to a French patent taken out by Mr. H. F. Smith, and briefly noticed in the above-named publication, the gas is passed through a diaphragm of glass wool at such a speed that the fibres are electrified. The very small particles are attracted to the fibres, or are carried through and coalesce into larger drops—being then removed by another filter. Large particles which are retained are removed by the gas stream on reversing the diaphragm.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Radiant Heat from Coke for Domestic Heating.

SIR,—In writing, at your request, some concluding remarks to the discussion on a paper I had read to the Society of Arts (being away from home), I gave an estimate of the proportion between the total heat of combustion and the radiant heat when coke is burnt in an open grate, which I find to be wrong. Please allow me to correct it.

In that comprehensive and trustworthy little book, "Numerical Tables and Constants in Elementary Science," by Sydney Lupton, the heat evolved in calories (gramme-degrees) on burning one gramme of gas coke is given as 8047. Changing gramme-degrees into kilogram-degrees, grammes into pounds, and calories into British thermal units, the total amount of heat yielded by the combustion of 1 lb. of coke is 14,490 B.Th.U.

The coke which fills my grate to the top weighs 34 lbs., and extends over the whole surface, which I have found it convenient to divide into ten "spaces"—a space being the area between two bars, which are two inches apart and, in this case, 18 inches long. This space is equal to a square 6 inches in the side, and when filled with glowing coke has been found to radiate on the average in each minute 49·64 B.Th.U. After fourteen hours' burning, the coke which is then glowing brightly covers three spaces only. Seven-tenths of the coke, weighing 23·8 lbs., has done its duty and passed away.

The average number of spaces which are thus filled at one time is 3·68, and the fire is then radiating out 182·7 B.Th.U. per minute. In fourteen hours the total radiation from the combustion of 23·8 lbs. of coke is $182{\cdot}7 \times 840$, and the radiation from 1 lb. of coke is:

$$\frac{182{\cdot}7 \times 840}{23{\cdot}8} = 6447.$$

Hence the percentage of the total heat of combustion which is sent forth by radiation is:

$$\frac{64470}{1449} = 44{\cdot}5.$$

This result, though not approaching the 86 per cent. referred to by Mr. L. B. Atkinson, is much higher than any of the previous estimations which I had heard.

A. VERNON HARCOURT.

St. Clare, Ryde, I.O.W., May 14, 1915.

Coal Prices and Miners' Wages.

SIR,—The "man in the street" has got the impression that colliery owners are making fabulous profits. This is quite a fallacy. Coal prices did not advance until the beginning of January this year, and the average selling price (as regards the Yorkshire collieries) has not advanced more than 4d. per ton for the first quarter of 1915, as against the fourth quarter of 1914. This advance does not by any means cover the increase which has taken place in the cost of production (labour and material) since the commencement of the war. It will, therefore, be seen that there must be many colliery owners who, in place of making huge profits, are actually in a worse position than prior to the war.

Negotiations are now on foot to grant the miners a war bonus—ostensibly to cover the increased cost of living. There can be no objection to this, provided that only men who work assiduously are allowed to participate. There is, however, a certain proportion of miners who will neither fight for their country nor work as they might do for their country's good—in other words, there is a proportion of "slackers." The effect of these slackers is that many pits are regularly averaging from 20 to 25 per cent. of absentees daily. Result: Increased cost of production and less coal for consumption. If a war bonus is granted to men of this type, it will simply represent a premium to increased indifference on their part. It should be definitely stipulated that any man who is physically able to follow his employment shall not participate in the benefits of any war bonus unless he is prepared to assist the welfare of his country in this time of need by working full time.

CARBONICUS.

Barnsley, May 14, 1915.

[With regard to the first part of our correspondent's letter, we know of fabulous prices that have had to be paid in the open market to compensate for shortages in delivery under contract, and instances are also known of the high-priced coal having come from quarters that have not, under the plea of deficient output, been fulfilling their contracts. With the second part of the letter, there is the most complete accord.—ED. J.G.L.]

Photo. Printing Charges—Preferential Electric Terms.

SIR,—The Ilkeston Town Council recently passed a resolution instructing Mr. S. F. James, the Town Clerk, to state a case for the opinion of counsel (Mr. W. C. Tyldesley Jones) as to whether it is legal to supply electrical energy for photo-printing purposes at the same rates as charged for power.

In answer to questions of mine put to the Local Government Board on the subject, the Board wrote:

> "The Board are not aware of any provision in the general law upon the subject, and are not aware of any decisions of the Courts upon the point."

I might also add that in connection with this electricity question, I resigned my position as Chairman of the Tramways and Electricity Committee.

The position now is that counsel's opinion has been received since the beginning of April, but it has not yet been made public. The Town Clerk read the opinion at the meeting of the Electricity Committee, but would not permit the writer to take a copy, nor any extracts, unless an undertaking were given to keep the matter strictly private, which the writer declined to do. Surely it is not necessary in this particular case that such secrecy should be demanded!

This is not a purely local question, but a matter affecting hundreds of corporations and scores of trades—other than photographers—throughout the country.

Again, counsel's opinion has been taken at the expense of the ratepayers; and as no litigation is in contemplation, is it not reasonable that the ratepayers should be allowed to know the views of counsel, and especially as the charges for energy to the photographers of Ilkeston have recently been advanced from power rates to lighting rates, on the plea that it is illegal to supply for photo-printing purposes at power rates?

If any of your readers will express their views on the point as to the necessity of keeping strictly private and confidential the opinion of counsel in this particular case, I shall be pleased.

(Councillor) WILLIAM SMITH.

Glossop House, Ilkeston, May 14, 1915.

[The writer of "Electricity Supply Memoranda" recently expressed an opinion on the question of the charges for current for the business of photo-printing—*ante*, p. 68. We certainly cannot see the object of keeping secret counsel's opinion on such a matter as this—particularly when the opinion might be useful to other people. But we should imagine that the gist of the opinion is supplied by our correspondent's remark, "that the charges for energy to the photographers of Ilkeston have recently been advanced from power rates to lighting rates on the plea that it is illegal to supply for photo-printing purposes at power rates."—ED. J.G.L.]

"Silly Theory" on Gas-Fire Heating.

SIR,—Your remarks on my letter of the 26th ult. are beside the point, simply because you will persist in referring to my figures as "estimated," whereas both in my original paper and in my letter of March 12, I referred to tests which corroborated these figures.

The tests taken with gas, coal, and electricity showed the comparative efficiency of the three methods of warming the same room. If you cannot see the difference between a test of practical efficiency in warming a room and a test for the total amount of radiant heat produced, I am afraid I cannot make the point any plainer, and see no use in further continuing the correspondence.

R. WEAVING.

Hollinwood, Lancs., May 10, 1915.

[Our correspondent is a particularly disappointing person. He is scrupulously careful not to discuss anything with us, and he will not answer any of the questions we have put to him, nor will he say whether the experts who have scientifically tested fires—and let us add in ordinary rooms, as well as under laboratory conditions—are worthy of credence, and are equally as eminent as Mr. Weaving in heat-subjects and heat-testing. However, if Mr. Weaving will run away from our interrogatories, he might, and he can if he will, tell us who made the tests which "corroborated" his figures, the conditions under which the tests were made, the appliances used in making the tests, and the types and approximate dates of production of the gas and electric fires. There are crude, unreliable ways of testing fires; and there are scientific ways. Which did Mr. Weaving adopt?—ED. J.G.L.]

Coal Prices and Exports.

SIR,—The report on the Yorkshire Coal Market to-day states, "that 'best hards' are temporarily reduced in price for export, on account of the uncertainty prevailing with regard to the prohibition of exports to neutral countries."

All coal can be reduced for home consumption if sufficient pressure is brought upon the Government to boldly see to it that British coal is reserved for British industries and British uses, instead of being shipped in ever-increasing quantities to neutral countries, for doubtful purposes in many cases.

The following official return relates to coal exports from Hull for the week ended the 4th of May, 1915:—

> "The official return of the exports of coal from Hull abroad for the week ended Tuesday last shows a total of 87,234 tons. The figures do not include bunker coal shipments for the British Admiralty, nor the Allied Governments. In the corresponding period of May, 1914, the total was 33,114 tons."

This return speaks volumes, and proves that the Government, by limiting the export of coal, are at last becoming alive to the true interests of the nation in this time of national peril, when cheap fuel is a dire necessity.

It is of paramount importance, also, that the Government, having come to this decision, should not allow it to be defeated by the issue of unlimited licences for coal to be exported, until the depleted stocks of the country are filled with coal at a reasonable price.

CONSUMER.

May 15, 1915.

Aspects of Co-Partnership.

SIR,—I notice in your issue of the 4th inst. a correspondent, referring to the co-partnership scheme of the South Metropolitan Gas Company and similar schemes, made the assertion that such systems of co-partnership have totally failed because, owing to the increased cost of raw materials and consequent rise in the price of gas, the workers' bonus has been considerably reduced.

As a worker under a system identical with those he mentions, I welcome the opportunity through your "Correspondence" columns of

controverting such an assertion, which proves that the writer, though claiming to have followed closely the scheme initiated by the late Sir George Livesey, has totally failed to understand it. This is evidenced by his suggestion that to make the workers' share dependent on the cost of raw materials was inherently bad, because presumably that is a factor beyond the control of the worker. In the first place, it is entirely incorrect to assume that, because our bonus is reduced, our system is a failure. On the contrary, those whose employment by these companies has been of long duration, have accumulated the results of years of reduced gas prices, invested in the stock of the companies, and still derive benefit from those institutions essential to co-partnership—the employee directorships and Co-Partnership Committees which keep alive that community of interest and goodwill between the directors and their employees which from the commencement have characterized these systems introduced by the late Sir George Livesey.

It appears to me that no other basis on which to award the bonus would produce such complete identity of interest. If, for instance, the bonus were based on the one factor of labour cost in production, it is quite conceivable that reduced labour charges would not be entirely due to the initiative or the increased exertions of the workers directly engaged in the production of the commodity, but might be caused by the introduction of labour-saving machinery or devices beyond the control of the men concerned. Thus whether the bonus was based on individual or collective work, it would not be co-partnership.

Our system, by making the workers' share depend on the price of gas, takes in all the factors in production and distribution, and though as a matter of course a reduced bonus is not so satisfactory, we realize that through our co-partnership we participate in both the prosperity and the adversity of our Company.

SOUTH SUBURBAN CO-PARTNER.

May 14, 1915.

REGISTER OF PATENTS.

Gas-Meters.

BRITTON, T. W., of Rathgar, co. Dublin, and the GAS-METER COMPANY, LIMITED, of Kingsland Road, N.E.

No. 3898; Feb. 14, 1914.

This invention has for its object to provide a meter which is very suitable for use with high-pressure gas.

Fig. 1 is a front elevation (partly in section) of a meter constructed according to the invention (part of the casing being removed), fig. 2 is a plan of the valve mechanism, figs. 3 and 4 are sections at right angles to each other through the casing.

The body of the meter comprises a horizontal cylindrical portion A provided with end covers, a cylindrical base portion B, and a cylindrical valve or distributing chamber C attached directly to A at right angles to it. The cylinder A contains circular bellows diaphragms D, of leather, clamped between smaller metal discs E on either size. These discs, with the diaphragm between them, are clamped together on a short stem F projecting from the outer disc into the slotted arm G of a cranked rod H or T-piece that transmits motion to the valves. A concentric ring K, made of metal, whose outer edge fits tightly and is soldered into the body of the meter, has a soft metal band L soldered round its inner edge, formed of a split metal tube, which, besides being split, is scalloped as shown, so that it can be opened for the reception of the leather diaphragm—an iron wire ring M being inserted into the metal tube and pressing over the leather, so that a gas-tight joint is formed.

As shown in fig. 4, the gas passes from the inlet to the valve chamber and thence direct to the measuring chamber of the bellows, as indicated by the arrows—being delivered therefrom to the exhaust or discharge chamber Y communicating with the outlet.

The index is placed in a box S in the front of meter, and may be taken out for inspection without interference with the internal mechanism of the meter. The spindle T, to which the index is connected, passes through a stuffing-box in the ordinary way. But as a further safeguard from leakage, a long socket U, with a flanged end, is placed on the index-spindle behind the stuffing-box, and between the back of the stuffing-box and flanged spindle a leather washer is fitted and kept constantly in place by a spring which extends between a collar soldered on to the index spindle and the flange on the socket, which is loose on the spindle.

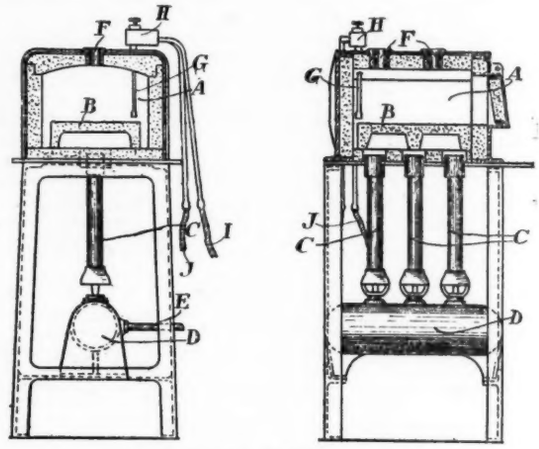
The principal advantages of the meter are said to be simplicity of construction and greater strength of the outlet casing as compared with other types of meter, with equal measuring capacity, simplicity of the valve chambers and diaphragms, "which greatly reduce the undue inertia resistance to working existing in the present type of dry gas-meters," simplified method of fixing leathers to new meters, and of removing and renewing when repairs to the meter are necessary. The connection of the discs to the horizontal stems which operate the valves allows more freedom of movement to the leather, which tends to keep it in a more supple condition, when the meter is working, than in the present form of leathers used, which have a tendency to collapse at the top as soon as they become dry."

Gas-Fired Furnaces.

HALL, I., of Aston, Birmingham.

No. 7238; March, 23, 1914.

This invention relates to a metal furnace wherein the heating chamber has an atmospheric low-pressure gas burner or burners in combination with a thermostatic device. Such devices are, of course, well known and generally used; and the invention is said to be confined strictly to the "combination" described.



Hall's Gas-Heated Metal-Furnace.

As illustrated, the heating chamber A is lined with fire-brick and surrounded by metal sheathing. If a series of such chambers was employed, they would be disposed above the other. A shield B is interposed to prevent the flame coming directly into contact with the articles to be heated. Preferably symmetrically disposed upon the floor of the chamber are arranged the tops of burners C, made in accordance with patents Nos. 5000 and 5888 of 1914. The gas is supplied to the burners from a chamber D, "in which the gas admitted from the supply pipe E becomes evenly distributed, and so enters each of the burners at equal pressure."

Arms or passages F would lead from the lowest heating chamber to the heating chambers where two or more were employed; and external vertical pipes with horizontal branches would lead to each chamber. Within (preferably) the uppermost heating chamber a thermostat G, adapted to actuate a regulating device H as described in patents No. 21,072 of 1912, Nos. 26,583 and 28,346 of 1913, and Nos. 5198 and 6016

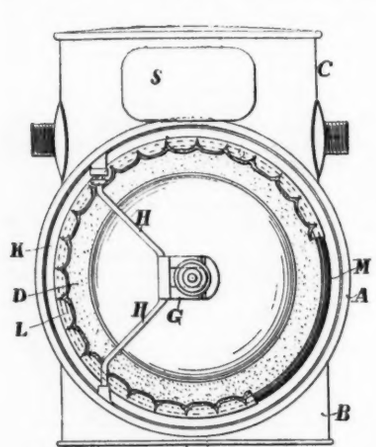


Fig. 1

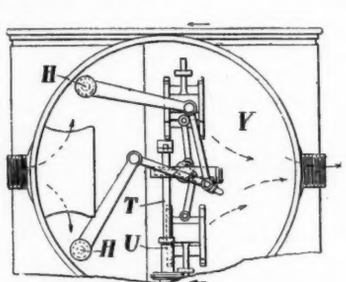


Fig. 2

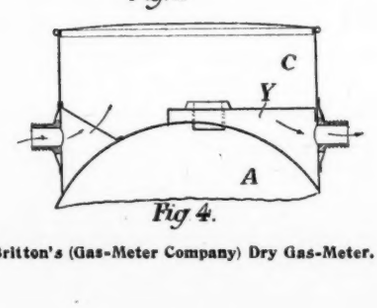


Fig 4.

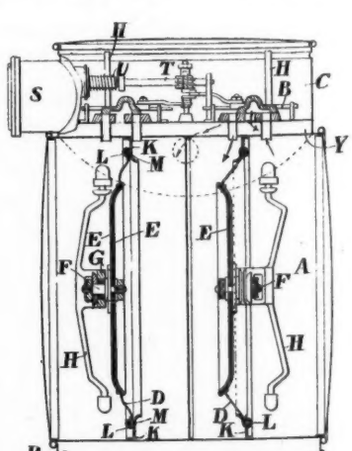


Fig 3

Britton's (Gas-Meter Company) Dry Gas-Meter.

of 1914. It is preferably disposed near the top of the furnace, and the gas is admitted by the pipe I and led from it to the gas-chamber A by flexible tubing J.

In cases where the temperature within the heating chamber is so high as to make it impossible or inadvisable to employ the thermostatic device directly within the chamber, it would be disposed within a special chamber adjacent to the heating chamber and preferably enclosed in the same sheathing.

Screening or Sifting Coke, Coal, &c.

DRAKES LIMITED, of Ovenden, Halifax, and WALKER, A., of Wallsend-on-Tyne.

No. 8439; April 3, 1914.

The patentees remark that in the screening or sifting of coke and other granulated substances it is often desirable that the particles of matter should have imparted to them a rolling movement in order that other and smaller particles adhering to one side or the other may be thrown off. With rotary sieves or screens, as heretofore constructed, it is found that the rolling and other motions are so violent as to considerably break up the substances treated—especially when screening coke.

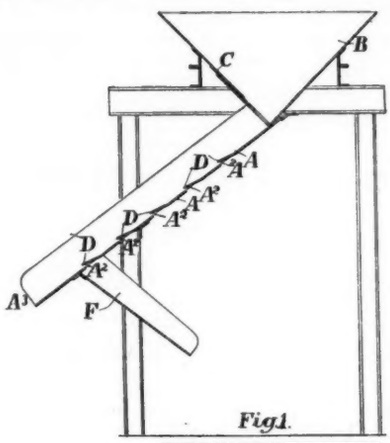
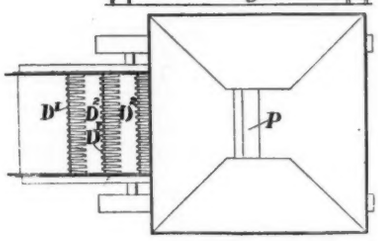


Fig 1.



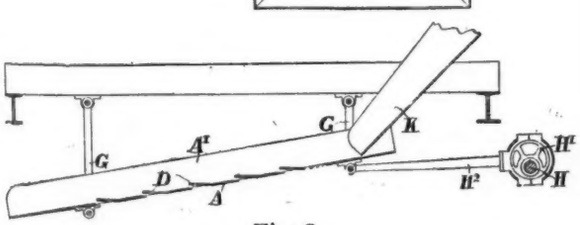


Fig. 2.

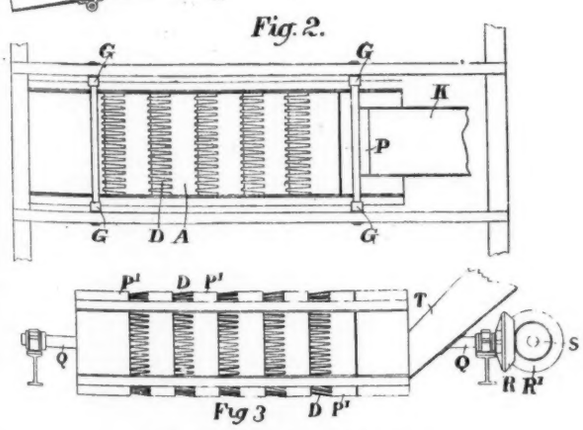


Fig 3

Drakes and Walker's Coke-Sifter.

In other forms of screens where longitudinal bars of a step-like character have been used, the effect desired has not been attained, since the bars have spaces adjoining them throughout the length of the screen, or have screening surfaces adjoining them produced by perforations being made through flat base rates—none of which formations permit the rolling motion of the substances being treated that are secured by the patentees' devices.

They propose to form screening surfaces, consisting of series of projections or fingers with plain or blank parts between them, in such manner that, while they do not in any way impair or deteriorate the substances treated, permit the substances to travel over them with the rolling motion described, while the extent of the motions may be increased or decreased as found necessary.

Fig. 1 is a side sectional elevation and plan of the sieve and its hopper. Fig 2 is a side sectional elevation and plan of a screen of the reciprocating type. Fig. 3 is a side elevation of a revolving screen.

On appropriate framework is mounted an inclined sieve or screen formed with blank parts A and open parts A^2, while at the outer edges are the sides A^1 which guide the substances over the screen as they descend from the hopper B, into which they fall and from which they escape when the door C is raised—spreading over the whole surface of the screen as they travel over it. The screening surface is formed by having spaces A^2 to alternate between the blank parts or base plates A; while overhanging the spaces, and at an angle to the base plates, are projections or fingers D, the outer ends of which are narrower than their bases. Thus the slots E between them are broader at their outer than they are at their inner ends; so that when the substances are rolling over the blank parts A, on encountering the fingers, the smaller particles pass between the fingers while the larger particles roll over and descend on to the succeeding portion of the screen's blank parts A. In this manner the larger particles get rid of, or discharge, the smaller particles by the latter passing through the openings E to the floor beneath, while the taper formation of the fingers prevents the wedging of any particles between them by reason of the force of succeeding particles causing them to travel forward.

The same formation of fingers D with intervening blank parts A is followed in producing a screen that has reciprocatory motion transmitted to it—as in fig. 2. Here connecting rods G are supported from the framework, while reciprocatory motion is transmitted to the swinging screen from the rotary shaft H, upon which is fixed an eccentric H^1—operating the sieve A by means of its connecting rod H^2. The granulated substances to be treated are supplied to the sieve down the shoot K.

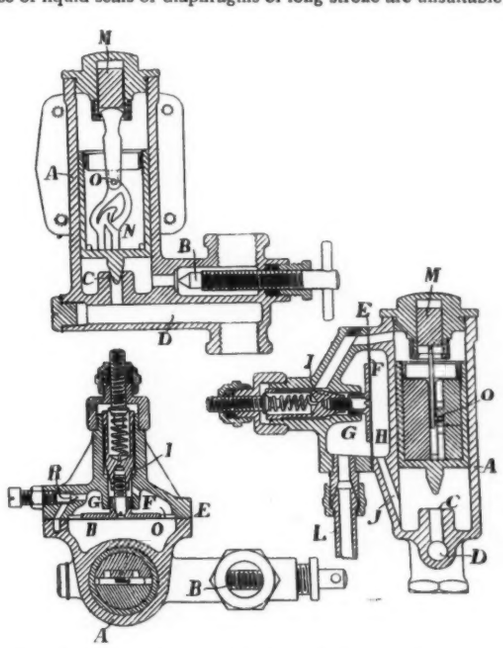
When applied to cylindrical screens as in fig. 3, the screen is mounted upon a shaft Q, to which motion is transmitted, through gearing wheels R and R^1, from a driving shaft S. The bases P^1, upon which fingers D extend, form the base of the screen. According to one arrangement the fingers extend at right angles from the edges of the bases P^1 (as shown), while according to another arrangement they extend at such an angle as will cause them to point in the opposite direction to the rotations of the cylindrical screen. The supplying of the granulated substances to the rotary screen is effected through the shoot T.

Automatically Lighting and Extinguishing Gas-Lamps.

KEITH, J. & G., of Farringdon Avenue, E.C.

No. 16,233; July 7, 1914.

This apparatus is for use in lighting and extinguishing the burners of gas-lamps by varying the pressure—"being so constructed as to permit certain burners of an installation to be lit and subsequently extinguished by a pressure wave without affecting other burners on the same main." Though applicable to low-pressure systems, the arrangement is more particularly adapted for high-pressure systems, "for which the types of apparatus heretofore adopted with low-pressure systems involving the use of liquid seals or diaphragms of long stroke are unsuitable."



Keith's Apparatus for Lighting and Extinguishing Lamps.

The invention is illustrated in vertical and horizontal cross sections. It includes a cylinder A (the lower part of which communicates with the gas supply) adapted to be controlled by a regulating or stop valve B. In the cylinder is fitted to slide loosely a vertically movable piston the lower end of which is formed with a conical valve member which, when the piston moves to its lowest position under the action of its own

weight, engages a seat C formed in the lower end of the cylinder and communicating with the burner or burners by way of a passage D. The piston is fitted with a controlling device to ensure that the down strokes shall be alternately complete and partial. Formed on one side of the cylinder is a casing E provided with a removable cap, within which is a thin metallic diaphragm F dividing the casing in two chambers G H. The chamber G (remote from the cylinder) communicates with the upper part of the cylinder—controlled by a valve I provided with a pin entering a socket of a disc engaging the diaphragm F. A spring (the stress of which is adaptad to be regulated) is arranged at the back of the valve so that it is normally closed, and communication between the upper part of the cylinder A and the chamber G is interrupted. The piston is so fitted within the cylinder A that gas from the lower part of it may flow by leakage past the piston to the upper part of the cylinder and accumulate there under pressure. The lower part of the cylinder communicates, by way of a port J, with the chamber H, which is in turn connected with the chamber G by means of a passage provided with a regulating device K. The pipe L leads to the pilot light, which receives a continuous supply of gas from the lower part of the cylinder A, being controlled by the regulating device K.

In the cylinder A is a piston controlling device serving to ensure that on alternate down-strokes of the piston it shall be suspended. This device comprises a pendulous member formed at its upper end with laterally projecting shoulders engaging an inwardly projecting flange of a collar secured to the cylinder cover. On the upward movement of the piston, the pendulous member is displaced; and on the subsequent downward movement the tendency of the pendulous member is to re-assume its vertical position under the action of the weight M, so that on engagement of the crown of the loop N by the pin O further descent of the piston will be positively prevented.

Under normal working pressure of the gas the force exerted in the chamber H upon the diaphragm is insufficient to open the valve I against the action of the spring. If, however, the pressure be increased temporarily, the valve will be opened and the gas contained under pressure in the upper part of the cylinder will escape to the chamber G, and thence through the pilot tube L. Owing to the decrease of pressure at the top of the piston within the cylinder, the pressure in the lower part of the cylinder causes the piston to rise to the top of its stroke, so that the valve member will be raised from the seat C—gas being thus permitted to flow by way of the passage D to the burner or burners. When the pressure is lowered to the normal working pressure, the valve I is closed by the action of the spring, and pressure again accumulates in the upper part of the cylinder A (due to leakage of gas past the piston); thus permitting the piston to descend. However, the piston is prevented (in the manner described) from completing its stroke; and thus the gas supply to the burner is not cut off. When the normal pressure is subsequently again temporarily increased, the pressure in the upper part of the cylinder is relieved (as described), so that the piston ascends. On cessation of the temporary increase of working pressure and consequent closing of the valve I and restoration of pressure on the upper side of the piston, the latter will again descend. But this time it is allowed to complete its stroke; thus cutting off the supply of gas to the burner.

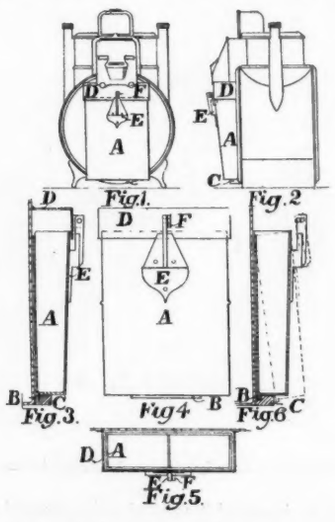
By adjustment of the stress of the spring tending to keep the valve I closed, the apparatus may be rendered susceptible of operation by an increase of pressure of predetermined magnitude; and consequently in an installation comprising a plurality of lighting and extinguishing apparatus, the springs of which are differently adjusted, a pressure wave of definite magnitude will initiate the operation of certain parts of the apparatus without affecting others.

Cash-Boxes for Automatic Slot-Meters.

THORP, F., of Whitefield, and THORP, H. T., of Prestwich, near Manchester.

No. 17,908; July 29, 1914.

This invention relates to "a strong, safe cash-box which can be readily removed when the meter is fixed in a cramped position." The box can be removed if there is an obstruction on both sides, or



Thorp's Automatic Meter Cash-Box.

at one side and also in front of the meter; but it is not possible to remove it "if the obstructions are on both sides and front of the meter at the same time unless the obstruction at the front is at least at a distance equal to the thickness of the box from front to back."

Fig. 1 is a front elevation of the meter with box attached; fig. 2, a side elevation; fig. 3, a sectional elevation of the cash-box and bridge; fig. 4, a front elevation; fig. 5, a sectional plan; and fig. 6, a sectional elevation showing the cash-box in two positions.

The box A, as shown, is oblong, having the top open. The bottom is closed, and carries a strong tongue B, which fits into a groove in the projecting piece C. The open end of the box fits into the rectangular opening formed by the bridge piece D. When the box is in position, the hole in the hasp E is opposite the hole in the hasp F, and, by fastening the two by a padlock, the box is securely fixed, and cannot be opened unless the padlock is properly removed or the box wilfully broken.

To detach the box the padlock must first be removed. The box must then be raised until the tongue B is clear of the groove in the projecting piece C. The bottom of the box is next drawn forward till the tongue is clear of the projecting piece (see fig. 6). Then, by pressing the box down until the top of it is clear of the bridge-piece D, it can be removed, as most convenient. In case of side obstruction, it can be drawn out in front; in case of front obstruction, it can be removed either to the left or the right as desired. If there are side obstructions and front obstructions at the same time the box can still be removed if the front obstruction is not at a less distance from the front of the box than the thickness of the box from the back to the front of the hasp E.

In order that the padlock cannot be attached unless the box is in the correct position—*i.e.*, the tongue B in the groove in the projecting piece C—the projecting piece is made of such a size as to produce an angular movement at the hasp sufficient to cross the holes in the two hasps, and thus prevent the padlock arm from passing—see fig. 6.

APPLICATIONS FOR LETTERS PATENT.

6613.—FELL, J. W., "Distilling shale or coal for the production of oil or illuminating gas." May 3.
6625.—ASHCROFT, E. A., "Production of toluene and like bodies (with bye-products) from other hydrocarbons." May 4.
6630.—JACKS, T., "Gasholders." May 4.
6650.—SPEARY, W. A., "Gas-economizer." May 4.
6683.—PRIEST, G., "Acetylene generators." May 4.
6739.—MERCER, A., YOUNG, E., and METERS LIMITED, "Coin-freed prepayment mechanism." May 5.
6743.—NOTT, G., "Acetylene generators." May 5.
6783.—MACKENZIE, W. G., "Gas fire-lighter." May 6.
6799.—STOTT, V. H., and SCHOFIELD, L., "Gas-heated boilers." May 6.
6822.—CANTON, A. A., "Gas-mantles." May 6.
6841.—WESTAWAY, J. C., "Gas-burners." May 7.
6873.—ANGLO-MEXICAN PETROLEUM PRODUCTS COMPANY, LTD., and BROUSSON, R. P., "Manufacture of gas." May 7.

RESTORATION OF LAPSED PATENT.

Notice is given that an order was made on May 5 restoring the letters patent granted to R. S. RICHARDS and R. W. PRINGLE for "Improvements in apparatus for the distillation of coal and the recovery of the products"—No. 15,643 of 1909.

Hyde Gas Company.

In moving the adoption of the report and accounts of this Company at the half-yearly meeting held on the 10th inst., the Chairman (Mr. G. F. Drinkwater) explained the principal items in the balance-sheet, and drew comparisons between the corresponding half year and the one under review. They were of a satisfactory and gratifying character, having regard to the adverse and abnormal conditions, difficulties, and embarrassments which had prevailed. There had been a steady rise in the cost of coal, stores, local rates, and wages, and a considerable drop in the price of coke, breeze, tar, and ammonia. The war had especially affected the sale of the two last-named residuals. Pitch rates to the South of France, usually about 8s. 6d. per ton, had risen to as high as 30s. At the present time the demand for this commodity had come to a standstill, and pitch had to be stored in this country until the end of the war. Before the war, pitch had been sold at £2 per ton; but since then as low as 10s. per ton had been taken. The outbreak of the war had also been responsible for the serious fall in the market price of ammonia, which was largely shipped to Germany; but this market was now closed for all purposes. The value of ammonia was also influenced by the high rates of freight due to the scarcity of steamers. The coke market had been a very poor one for the last year or two; and though at present this residual was commanding a high figure, the half year under review did not benefit to a great extent by the advance of prices. Notwithstanding these serious drawbacks, a trade profit had been made of £4621, which would enable the full statutory dividends to be paid. It was also a pleasing fact that there had been an increased consumption of 3½ million cubic feet of gas on the twelve months' working. The price of coal continued to increase, and as much as 6s. per ton was being exacted above last year's prices. The prospective increased cost of coal alone would mean an additional charge of more than £4000 over last year's prices. The Company had not raised the price of gas since 1910, notwithstanding the increased cost of production. It was fully expected that the new vertical retort installation would early next month be working to its fullest capacity, and producing the results anticipated and guaranteed. The works and distributing plant had been efficiently maintained, and certain important additions and improvements had recently been carried out. The report was adopted; and a vote of thanks was subsequently accorded to the Manager and Secretary, Mr. Charles Potts.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills brought from the Commons, read the first time, and referred to the Examiners: Barnoldswick Water, Chelmsford Corporation Gas, Dewsbury Corporation, Statutory Companies (Redeemable Stock), Metropolitan Water Board, Rhondda District Council, Southend Water.

Bills read a second time and committed: Bury and District Joint Water Board, Skegness Gas.

Bills reported, with amendments: Doncaster Corporation, Prescot Gas, Wolverhampton Corporation Water.

Bills read the third time and passed: Ascot Gas and Electricity, South Staffordshire Water, West Gloucestershire Water.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Bills brought from the Lords, read the first time, and referred to the Examiners: South Staffordshire Water, West Gloucestershire Water.

Lords Bills read a second time and committed: Brighton and Hove Gas, Frimley and Farnborough District Water, Ormskirk Gas and Electricity, Sunderland Corporation (Wearmouth Bridge), Warwick Gas.

Bills read the third time and passed: Barnoldswick Water, Chelmsford Corporation Gas, Dewsbury Corporation, Metropolitan Water Board, Rhondda District Council, Southend Water.

The Statutory Companies (Redeemable Stock) Bill [see *ante*, p. 339] was considered on Monday last week, reported, read the third time, and passed.

The Gas and Water Provisional Orders (No. 1) Bill has been read a second time and committed.

DONCASTER CORPORATION BILL.

This Bill was sent forward for third reading by the Unopposed Bills Committee of the House of Lords last Tuesday. No vital amendments have been made since those introduced into the Bill when it was before the Local Legislation Committee of the House of Commons [see "JOURNAL," March 16, p. 678]. There was an impression that the authorities of the two Houses would insist upon the 500 B.Th.U. calorific standard without a margin, in order to prevent the lack of uniformity brought about by some Bills having this standard and others having 540 B.Th.U. with the 7½ per cent. margin. The Bill, however, still has the latter standard, and has only to pass the third reading before receiving the Royal Assent.

PRESCOT GAS BILL.

The Unopposed Bills Committee of the House of Lords last Tuesday sent this Bill forward for third reading.

The objects of the Bill are to consolidate and convert the capital of the Prescot Gas Company, and to raise £18,000 of additional capital. The calorific standard of 500 B.Th.U., with 7½ per cent. margin, is included. The following clause was added:

> Nothing in this Act shall exempt the Company or their undertaking from the provisions of any General Act relating to the supply of gas which may be passed in this or any future session of Parliament.

A similar clause has been inserted in other Gas Bills this session. It emanates from the Board of Trade, and is said to aim mainly at providing for subsequent uniformity in the calorific clauses.

[The matter was discussed before the Unopposed Bills Committee of the House of Commons last Wednesday.]

STAFFORD GAS ORDER.

Before the Unopposed Bills Committee of the House of Commons last Wednesday, the genesis of the clause set out in connection with the report of the Prescot Gas Bill was discussed in relation to the Stafford Provisional Order.

The Order authorizes the additional use of lands for gas purposes and substitutes the 540 B.Th.U. and 7½ per cent. margin calorific clauses for those prescribing the old illuminating power test. The Local Government Board have imposed this test in three cases this session; and Stafford is the first to come before the House.

Mr. ERNEST MOON, K.C. (the Speaker's Counsel): Have you the saving clause?

Mr. WOOD, of the Local Government Board, said the Board did not think there should be a saving clause; but if the Committee thought it desirable, it could be inserted. His opinion was that if hereafter there was to be legislation, that legislation would possibly provide for the new conditions applying to existing undertakings. If it did apply to existing undertakings, nothing in the Order now under consideration would prevent its application.

Mr. MOON said the intention was to give people warning that new legislation may be embarked upon. He understood this was the view of the Board of Trade, who put the clause into several Bills last year which contained calorific clauses. It would very likely be necessary, when more experience was obtained on the subject, to deal with the matter in a General Bill; and promoters were warned that, in these circumstances, they must be prepared to meet what the General Bill might require.

Mr. WOOD replied that hitherto this had been in the case of companies and not local authorities. He did not know whether this made any difference.

Mr. MOON agreed that it might make a difference; but the Board of Trade wanted it put in in both classes of Bills.

The saving clause was then added to the Order under consideration.

ASHINGTON URBAN DISTRICT COUNCIL BILL.

A Committee of the House of Lords, presided over by the MARQUIS OF BATH, commenced consideration of this Bill on the 5th inst.

Mr. HONORATUS LLOYD, K.C., Mr. G. J. TALBOT, K.C., and Mr. F. N. KEEN appeared for the Council. The opponents included the Tynemouth Corporation, the Morpeth Rural District Council, and the River Coquet Conservancy Board.

The object of the Bill is to acquire water which rises in certain springs some distance outside Ashington (called the Tosson Springs), to construct a service reservoir, and lay the necessary aqueduct. Prior to 1906, the water in Ashington was supplied mainly by the Ashington Coal Company and partly by the Millburn Estates, Limited. In December, 1906, however, the Council decided to take over the distribution themselves, and arrangements were made for taking the water in bulk from the Companies. The present supply is perfectly satisfactory; but in view of the increasing needs of the districts, it is felt that further sources of supply are necessary. Hence the present proposals, which are estimated to cost some £73,000, in addition to which a loan of £8000 is asked for in connection with mains extensions.

The chief opposition was from the Tynemouth Corporation, who at various times have been in negotiation with the Ashington Council with a view to giving a supply in bulk. A supply of 800,000 gallons per day is anticipated from the new springs; but the Tynemouth Corporation urged that a cheaper scheme would be to take this quantity in bulk from them. The Corporation obtained *locus* against the Bill, inasmuch as they purchased certain lands in which the Tosson Springs are situated immediately they knew of the Ashington Council's intention to promote their Bill. The Tynemouth Corporation called to their aid a report of the Local Government Board which stated that the Committee should be assured that no alternative scheme, not involving a heavy capital expenditure, was available. Their bulk-supply proposal, they contended, met this condition. The Board also expressed the opinion that the proposed scheme seemed to involve needless expenditure.

After an inquiry which lasted until last Thursday, the Committee passed the preamble of the Bill, and imposed a limit of 400,000 gallons per day for the compensation water to be provided.

ASCOT GAS AND ELECTRICITY BILL.

An interesting point was raised last Tuesday when this Bill was before the Unopposed Bills Committee of the House of Lords. The measure has already passed the House of Commons [see "JOURNAL" for March 16, p. 677], and no alterations have been made since.

The point raised before the Committee relates to the Statutory Companies (Redeemable Stock) Bill, which enables statutory companies to issue redeemable preference or debenture stock. These companies can at present only issue stock on war terms, and in most cases will have no power (apart from the powers under the Bill) to redeem any stock so issued when normal conditions again prevail. The terms of the Bill were given in the "JOURNAL" last week (p. 339).

Mr. F. E. COOPER (Parliamentary Agent) asked the Lord Chairman to insert an amendment in the Ascot Bill so that the Company could benefit by the Statutory Companies (Redeemable Stock) Bill. He pointed out that, under clause 5 of the latter, it only applied to stock authorized to be created or to be issued before the outbreak of the present war, or after the outbreak of the present war and before the coming into force of the Government Bill. As it was possible that the Ascot Bill might receive Royal Assent a few days after assent was given to the Government Bill, the Company would then be deprived of the advantages of the latter; and it was in order to avoid this that he asked for an amendment in his Bill.

Mr. GRAY (the Lord Chairman's Counsel) suggested that the matter should be discussed with the Board of Trade.

Mr. COOPER said the officials whom he had seen in that Department regarded the suggested amendment in the Ascot Bill as sensible.

The LORD CHAIRMAN said it would be an improper thing for the Committee to do what was suggested while a Public Bill was passing through the House.

Mr. GRAY said that as the Government Bill would soon be sent to the House of Lords, it would probably be best for the promoters to use their influence to secure an amendment of the Government Bill there.

Mr. COOPER said he took it then that it was beyond the power of the Committee to make the suggested amendment in the Ascot Bill.

The LORD CHAIRMAN said it was probably within the power of the Committee; but it would be an improper action, having regard to the fact that the Government Bill had not yet passed the House.

The matter was left there, and the Bill was ordered to be reported for third reading.

School Lighting at Leytonstone.—The lighting of the Leytonstone schools by inverted incandescent burners has been considered by a Committee of the Bethnal Green Guardians. This method of lighting is now in force at Waterloo House; and the saving in the consumption of gas there for three months amounted to £104, while the actual cost of installing the system was £265. The Gas Light and Coke Company have offered to instal a similar system at the schools for £191; and the Committee recommend the Board to accept this offer.

LEGAL INTELLIGENCE.

INJURIES CAUSED BY A MOTOR-LORRY.

Action against the South Metropolitan Gas Company.

Last Wednesday, the case of *Davies v. South Metropolitan Gas Company* was before Mr. Justice DARLING and a SPECIAL JURY. The action was brought to recover damages in respect of injuries caused by defendants' servant. Defendants denied negligence, and, alternatively, said that, if the accident occurred, it was through the contributory negligence of the plaintiff.

Mr. SANDERSON, K.C., and Mr. LIVERSEDGE appeared for plaintiff; Mr. CLAVELL SALTER, K.C., and Mr. PATRICK HASTINGS represented the defendants.

Mr. SANDERSON said the plaintiff, John Davies, a chemist, of No. 119, Railton Road, Herne Hill, sought to recover damages in respect of personal injuries received by him on Nov. 11, 1914. He based his claim on the negligence of the driver of a motor-lorry belonging to defendants. Plaintiff was in the habit of taking a cycle ride every morning, and on the day in question he was returning from his usual ride about 7 o'clock in the morning. He had to go through the Norwood Road, along which there were two sets of tram lines; the up-line being 2 or 3 feet from the kerb. Plaintiff rode between the metals of the up-road with the intention of turning to his left into the Dulwich Road; and as he approached the corner, he found in front there was a tram-car, which was slowing-down, so he pulled out to the right. The car then went on, leaving an opening clear for plaintiff to turn into the Dulwich Road, when the motor-lorry, which had come from the direction of the Dulwich Road, and was on its wrong side, going at the rate of from 8 to 10 miles an hour, cut in between the tail of the car and the kerb, and ran into plaintiff, causing severe injury and smashing the bicycle. When the lorry pulled up, the off-side wheel was just inside the nearest tram line; so there could be no doubt that it was on its wrong side.

Medical evidence having been given, plaintiff was called and bore out his Counsel's opening. Corroborative testimony was given by several witnesses that the driver of the lorry was on his wrong side of the road.

Mr. SALTER, for the defendants, admitted that, if his driver was in the wrong, plaintiff was entitled to fair compensation for pain and suffering and out-of-pocket expenses; but according to the evidence he should call it was plain that plaintiff was on his wrong side of the road, and ran into the lorry. If this was the case, defendants were not liable, as the accident was brought about by plaintiff's own negligence. Had plaintiff looked to see where he was going before he came out from behind the car the accident would not have happened.

W. H. Skeats, the driver of the motor-lorry, denied that he was on his wrong side, and said that as soon as plaintiff came from behind the car he was into the lorry.

Arthur Monk, foreman lamp attendant in defendants' employ, who was near the scene of the accident on the day in question, said the lorry was on its proper side of the road.

W. Hodges, who was travelling on the lorry, gave similar evidence.

In the result, the Jury found for the plaintiff, and assessed the damages at £175.

His LORDSHIP entered judgment accordingly.

ACTION OVER A GAS-PLANT WARRANTY.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

(*Before Mr. Justice* ATKIN.)

Cory Brothers and Co., Limited, v. Mather and Platt, Limited.

In this case (which was before the Court last Thursday and Friday), Messrs. Cory Brothers and Co., Limited, of Cardiff and Swansea, sued Messrs. Mather and Platt, Limited, manufacturing engineers, of Manchester, for damages for alleged breach of warranty in connection with a gas-plant supplied to their collieries at Aber, near Pontypridd. Defendants denied the allegations.

There appeared for the plaintiffs, Mr. LESLIE SCOTT, K.C., M.P., Mr. INSKIP, K.C., and Mr. HENN COLLINS; for the defendants, Mr. LANGDON, K.C., Mr. A. J. WALTER, K.C., and Mr. E. H. TINDAL ATKINSON.

Mr. LESLIE SCOTT said the action was one for damages for alleged breach of warranty in relation to a large installation of gas power plant, at the plaintiffs' colliery in South Wales. The whole contract for gas-producers and gas-engines was made with the defendants. But the defendants did not themselves manufacture gas-producers; and these were supplied by Masons Limited, under a sub-contract with defendants, who made themselves responsible for the whole installation. The contract was entered into in 1907; and attempts were made to work the plant up to 1913. Finally, after the plaintiffs had been very patient indeed, the writ in the action was issued, and heavy damages claimed, as the plant was an expensive one, and was found to be of no use for the purpose for which it was supplied. The plant was guaranteed to be suitable for the work which had to be done. It was supplied for a particular purpose; and it did not perform the work for which it was bought. The only question of law in the case, so far as liability was concerned, was the question as to the scope of the guarantees of the contract, which was in writing; the rest was pure fact. The plant was accepted and wholly paid for; and this was why they sued for breach of warranty. The plant was largely needed for the purposes of working the Penllwyngwent Colliery, when it was opened up. At the time of the negotiations, the plaintiffs were working a seam called the six-foot in the Wyndham Colliery. They used a screen of 1½ inches, so that all the coal smaller than this passed through, leaving the larger pieces above. The coal was steam and bituminous; and the small coal was of little value for market purposes. The idea of the plant was that the owners of the colliery might use the small coal for it, thus driving the whole of the colliery with coal which was of very low market value. This was the fundamental point of the whole case. The plaintiffs knew that as soon as they opened up the Penllwyngwent seam they would have the same coal there as they had at the Wyndham; and they thought that the use of this coal would save a great deal in the cost of running the colliery. Among the defences was an allegation that the sample coal given to defendants was not a fair sample of the coal subsequently used by the plaintiffs in the gas-producer ultimately ordered. They denied any breach of warranty, guarantees, or terms or conditions, or the failure of the gas-engines. Defendants also said that if there was any failure it was caused by the inefficiency of the auxiliary steam plant, which was not installed by the defendants, and the inexpert and maladroit manner in which the whole plant was worked by the plaintiffs' employees. Broadly speaking, the plaintiffs claimed that the defendants had not given them a plant which would work. They did not mind whether it was the engine or the gas-producer which was to blame. In consequence of the failure of the engines to work as plaintiffs anticipated, they had been compelled to use anthracite coal to keep the colliery working, at 27s. per ton, instead of their own Wyndham small coal, which cost only 6s. per ton. In the course of letters which passed in 1911, it was mentioned that, owing to leakage in the engines, there had been several cases of "gassing" among the men working in the colliery. In some of their letters, the defendants suggested that if fans were used the results would be better; and this was, in fact, done by the plaintiffs. Tests made by Mr. Day, of Cardiff, in 1912, showed that the whole of the gas-plant was far short of producing the contract efficiency in brake-horse-power.

The hearing was adjourned until yesterday (Monday).

The Lighting of the Public Streets.

At the Lambeth County Court last Friday, before Judge Parry, George Brown, a taxi-cab proprietor, brought an action to recover damages for injuries to a cab against the Lambeth Borough Council. Mr. Lever, for plaintiff, said that on the night of Jan. 6, a driver in the employment of the plaintiff, when approaching Effra Road, came to a shaded gas-lamp, which threw a glare on the road immediately below it, and as soon as he came from beneath the glare he was plunged into total darkness. A short distance away was a refuge, on which was an electric arc lamp. At the time of the accident, however, this was out; the result being that the driver ran into the refuge, smashing the lamp-column and damaging the car. The driver of the taxi-cab bore out this statement, adding that when he approached the refuge he slowed-down to a speed of eight miles an hour. Mr. Bruce Penny, the Town Clerk of Lambeth, for the defence, maintained that there was no negligence on the part of the Council, inasmuch as the lighting arrangements were carried out by the Gas Company and the South London Electric Supply Corporation. The Council were not responsible for the accident, as they were acting under the instructions of the Chief Commissioner of Police. Mr. H. C. J. Edwards, the Borough Engineer, stated that the lamps had been shaded at the instigation of the police, who approved of the measures taken by him and his staff. Evidence was given that the electric arc lamp should have been in working order at the time of the accident, and that it should have been alight, as it was found to be burning at eleven o'clock on the morning after the accident. Mr. Lever pointed out that, under a recent decision in the High Court when a similar action was taken against the Poplar Borough Council, the Council were responsible for an accident of this nature. Judge Parry said, in view of the importance of the case, he should reserve his decision.

Re-Connecting a Gas-Meter.

In the Dublin Southern Police Court, the Alliance and Dublin Consumers' Gas Company prosecuted Frank Curran, of Inchicore, for illegally re-connecting a gas-meter without their permission. Inspector Leadbetter stated that the meter had been disconnected on April 15; and Inspector Larkin proved finding that a re-connection had been made. A fine of 20s. was imposed.

A Winding-up Order.

Last Tuesday a petition presented by the Gas Light and Coke Company for the compulsory winding-up of the Bivibed Syndicate, Limited, came before Mr. Justice Astbury. Mr. Bischoff said the petitioners were judgment creditors for £65; and the petition had stood over for a month to enable the Syndicate (if possible) to pay the debt. But no arrangement had been made; and he therefore asked for the usual order. There was no appearance on behalf of the Syndicate; and his Lordship made an order for compulsory winding-up.

Monte Video Gas Company, Limited.—The Directors will report at the meeting to-morrow that the profit on the working of the year 1914, as shown by the revenue account, is £23 961; and after providing for interest on debenture stock and other charges, and including £12,841 brought forward from the previous year, the balance at the credit of profit and loss available for dividend is £29,512. As compared with 1913, this shows a reduction of £5005. An interim dividend of 6s. per share (less income-tax) was paid in respect of the half year ended June 30; and the Board now recommend the payment of a further amount of 6s. per share (also less income-tax), making together a dividend of 3 per cent. for the year, and carrying forward a balance of £13,255. The balance at the credit of the reserve account remains at £32,000, the contingency account stands at £17,739, and the insurance fund at £12,500. Over the year, the sales of gas increased 9 62 per cent.; but in the latter months the figures were affected by the serious financial crisis through which Monte Video is passing.

MISCELLANEOUS NEWS.

ILLUMINATING POWER OF LONDON GAS.

Deficiencies Due to the War.

At the Meeting of the London County Council to-day, the Public Control Committee will present the following report on deficiencies which have occurred in the illuminating power of London gas.

The gas supplied by the Gas Light and Coke Company at seven testing-stations on various dates in September, October, and December, 1914, was found to be deficient in illuminating power. Similar deficiencies were also reported in the gas supplied by the Commercial Gas Company at one testing-station in July, 1914, and at another in February, 1915.

In all cases appeals were lodged by the Companies, and they were heard by the Chief Gas Examiner (Lord Rayleigh, F.R.S) on the 18th of March last. Under his award, a forfeiture of £25 was imposed on the Gas Light and Coke Company, in respect of the supply at Ladbroke Grove testing-station on Sept. 14, 1914. The Chief Gas Examiner also decided that the reports concerning the Kingsland Road station on 7th, 8th, and 9th of September, 1914, and the Lambeth Road station on 14th, 15th, and 16th of October, 1914, must stand—the Company thereby incurring a forfeiture of £2 for each station. With regard to a number of deficiencies between the 23rd and 31st of December, 1914, the Chief Gas Examiner decided that the war and attendant difficulties might be regarded as an unavoidable cause and accident within the meaning of the Statute. The reports of the Examiners were accordingly cancelled.

In the case of the Commercial Gas Company, it was contended that the deficiency at Wellclose Square station on July 8, 1914, was due to the breakdown of part of the plant; and the Chief Gas Examiner decided that this might fairly be regarded as an unavoidable cause and accident. The report of the Gas Examiner was accordingly cancelled. With regard to the deficiency at the Parnell Road station on Feb. 9, 1915, he decided that the report must stand; and he imposed a forfeiture of £25.

THE STRIKE AT THE BIRKENHEAD GAS-WORKS.

Refreshments for the "Bantams."

There was a long discussion at the last monthly meeting of the Birkenhead Town Council in regard to the supply of refreshments to the "Bantams" who rendered assistance at the gas-works during the period of the strike. The question arose on the accounts presented by the Gas Committee, which contained an item of £234 for the purpose named. This was objected to by Mr. Adams, who moved, as an amendment to the motion for the adoption of the minutes of the Committee, that the sum should be surcharged to the individuals who were responsible.

In support of his amendment, Mr. ADAMS said that when they came to consider that the country was asking that they should do all they possibly could to avoid any drinking among soldiers, and that the Gas Committee were responsible for serving these men with drink, it was setting a very bad example. It was most unfair, and he wanted to know the person or persons who gave their Engineers authority to order intoxicating drink into the gas-works.

The MAYOR (Alderman A. H. Harkle) pointed out that Mr. Adams could only move that the matter be referred back.

This he did, and he was seconded by Mr. FRAME, who said it was in utter defiance of the Chief War Lord that a corporation should pass an account for the supply of intoxicating drink to soldiers—a thing which it was thought they should be saved from, and one which was decried. The sum of £234 was put down for refreshments in order to blind them.

Mr. ROWLAND thought it was scarcely fair to put the whole responsibility of the supply of the "Bantams" with liquor on to the shoulders of the Gas Committee, who were not, in fact, aware that these refreshments had been sent until about half way through the strike. He then moved in Committee that no more drink should be sent down to the gas-works. He did not think the management at the gas-works should do anything without the consent of the Committee.

Alderman SHAW submitted that what had been done at the gas-works in regard to the supply of beer and whisky was nothing more nor less than the duty of the Gas Committee. Some refreshments ought to have been supplied to those men who so nobly came forward and took the places of the men who were on strike. What would the town have done during the strike if the "Bantams" had not gone there, and by dint of hard work got them out of a difficulty? Instead of grumbling, the Council ought to pass a vote of thanks to the soldiers for the work they had done. If he were a member of the Committee, he should rejoice in the fact that they could rise superior to local prejudices and silly notions.

Mr. FORSYTHE said Alderman M'Gaul (the Chairman of the Gas Committee) ought to be ashamed of himself for putting in the hands of the "Bantams" what was the temptation and downfall of many young men. He thought that if they carried the resolution of the Committee it would be a standing disgrace to them. The Council were asked to sanction something which was contrary to the interests of the country at large.

Alderman M'GAUL said he had been told that he ought to be ashamed of himself. He was not. The Labour party were exploiting the matter merely because there had been a strike. The liquid refreshment was ordered by the Commanding Officer, who said, "Unless you have refreshments in for these men I cannot possibly keep them in the place." The amount spent on the whole thing was £79 11s. 3d., and with 180 men employed for 23 or 24 days it worked out at 4½d. per day per man. Yet the Labour party, to bolster up their case, stated that the men got three pints of beer every four hours. The Committee were charged with making the men drunk. There was no drunken man at the gas-works who got his beer inside. The drink was in charge of one of the men's officials, and no man could get more than what his one tally gave him for eight hours. The speaker added: I saw the "Bantams" at work, and while I am a teetotaller I quite sympathized with their request for refreshments, considering the exceptional circumstances. I am not mad enough a teetotaller to say that every man should do as I do. I am ashamed of what has gone on here to-day.

The amendment was lost by 32 votes to 12.

Subsequently the subject of the remuneration of gas-works officials for unusual services rendered during the strike was considered.

Mr. TUTTY moved to refer back a proposal that £209 should be granted in gratuities to members of the gas-works staff and others for extra services, and also proposed that a Committee be appointed to inquire into the management of the gas undertaking. He said he noticed that when the men went out on strike, though the Council were paying men for their knowledge of gas making who were beneficiaries under that proposal, they had to have outside help, which cost £226 19s.

Mr. EGAN, in seconding the motion, said, considering the future, they ought not to be rewarding the people in question. The strike should not have lasted two days, and yet it lasted three weeks. It cost the Council £230 for assistance, and there was a loss of revenue of about £1500. He thought there ought to be an investigation.

The MAYOR ruled that the Council could only refer the minute back. A proposal for a Committee of Inquiry would have to be a separate motion.

Alderman M'GAUL said it would be within the memory of the Council that during the railway strike a certain amount of risk was run by a number of workmen who insisted on remaining at the gas-works. The Gas Committee gave these men a full week's wages, which amounted to £230, for doing nothing. Why should they not give grants to the men who had now done such yeoman service to the town?

The amendment was lost by 18 votes to 11.

Mr. W. Thorne on Thursday gave notice of his intention to ask the Under-Secretary of State for War whether he was aware that on the recent occasion when men of a Bantam Regiment were employed at the Birkenhead Gas-Works, in place of men on strike, alcoholic and other refreshments of the value of upwards of £70 were supplied to the soldiers by order of the commanding officer; whether he would state under what authority this was done; and whether, as the expense was incurred at the instance of the commanding officer, the War Office was prepared to defray it, and not have it imposed upon the ratepayers of Birkenhead, who had no control in the matter.

OTTOMAN GAS COMPANY, LIMITED.

A Distribution from the Reserves.

The Half-Yearly Ordinary General Meeting of the Company was held last Tuesday, at the London Offices, Nos. 59 and 60, Gracechurch Street, E.C.—Colonel JAMES LEGEYT DANIELL (the Chairman) presiding. It was explained, in the circular calling the meeting, that, owing to the war, the Directors did not present the usual report and accounts.

The SECRETARY (Mr. C. J. DAUN) having read the notice convening the meeting,

The CHAIRMAN said he rose to move a distribution from the reserves of the Company of a dividend at the rate of 7 per cent. per annum on the preference shares (less income-tax), and at the rate of 2 per cent. per annum on the ordinary shares (tax free), making 6 per cent. for the year—both for the half year ended Dec. 31 last. He wished, however, first of all to allude to the loss which the Company had sustained by the death of Mr. Henry Ward Andrews, who had served the Company as Engineer and Manager at Smyrna for seventeen years, and on his return to England was for a short period Consulting Engineer, and subsequently a Director, for, he thought, some eighteen years, to the date of his death. The proprietors would be able to judge of the character and particular value of the experience which he brought to bear on the counsels of the Board—in a manner, he might say, always agreeable to his colleagues. In Mr. Andrews' place, the Directors had elected a gentleman well known to all the shareholders, as well as to everyone in his profession, in the person of Mr. Arthur F. Phillips, who, in consequence, had retired from the position of Consulting Engineer to the Company. On the last occasion when the Board had the pleasure of meeting the proprietors, he ventured to say no one would have contemplated such a thing as this country being brought to war with Turkey. But so it was; and the position of the Company had been, and still remained, in consequence a difficult one. On the declaration of war, all communication with England was closed. The censorship was strict; and little or nothing came through. He had, therefore, very little to tell the shareholders. In a round-about way, they at times managed to get a little intelligence. As an instance, he might say that an acquaintance of the Manager in Smyrna was asked to call, on his return to England, at the Company's London offices. This he did, and told the Secretary that Mr. Gandon and his staff were well. He also confirmed the intelligence, of which the Directors were already in possession, that a notice had been received early in November from the Minister of Public Works, to the effect "that under the decision of the Ottoman Goverment all foreign companies of utility came under the control of the Government, and that a Commissaire would enter and supervise the working of the accounts, and see that all was in order." After a visit or two from this authority, he discontinued them, and matters appeared to have been going on much as usual. Mr. Gandon had under a limited permit paid a short visit or two to Athens, from Smyrna, and the Directors had thereby gleaned a little news. But the censorship was as strict for Greece as for England However, the previous night he had received from the Company's office intelligence,

which came through Athens, and was dated April 28, that everything was quiet. The members of the staff in Smyrna were Mr. Gandon, his son, and Mr. Hadkinson; and when speaking of the Chief, they must not forget the others. In these times of stress and anxiety, they had kept their heads, and had done well. He frequently found occasion to refer to Mr. Gandon's services to the Company; and this certainly was not the time for silence. Situated as their Manager was, he had to act on his own judgment. Later on the Company might be able to judge of the extent to which they were indebted to him. Of course, the position was one of anxiety. Having, however, gone so far unscathed, let them hope that they might not suffer much in the future. The Directors foresaw that the expense necessary for the protection and proper maintenance of the property might not be inconsiderable. With this before them—and they must have money—the Board felt sure that the proprietors would appreciate the position, and would recognize the fact that the Directors had done all they prudently could in recommending a distribution for the last half of 1914 in the terms of his resolution. When this terrible war was over, and the reports and accounts could be resumed as in the past, he for one felt confident that the shareholders would all show their approval of the account the Board hoped to make of their stewardship.

Mr. A. M. PADDON seconded the motion; and it was at once carried unanimously.

On the proposition of the CHAIRMAN, seconded by Colonel STEPHENSON R. CLARKE, C B, Mr. Paddon was re-elected a Director of the Company.

Mr. PADDON, in acknowledgment, remarked that a very long time had elapsed since he was personally in conversant touch with Turkish affairs in Turkey—so long that his experience in this way had almost become a negative asset. And he could only hope that this experience would become of still less value day by day, as the influence of our country was asserted in the war. The interests of the proprietors and of the Directors of the Company were precisely identical with the interests of their country from this time forward; and it might be some consolation to them, in these hard times, to feel that their cause was the cause of humanity, of progress, and of every human interest of any value in the world. ["Hear, hear."]

Thereafter the Auditors (Messrs. T. H. Cooke and F. W. Church) were reappointed, on the motion of Mr. COLLINGWOOD, seconded by Mr. CLARKE.

On the proposition of the CHAIRMAN, a vote of thanks was passed to the Engineer and Manager, the Secretary, and the staff in Smyrna and London.

Mr. R. L. ANDREWS, in proposing a vote of thanks to the Chairman and Directors, said he wished particularly to thank the Chairman for his remarks about his (the speaker's) brother. Of all the companies with which the late Mr. H. W. Andrews was associated, the Ottoman Company was one of his first considerations. He (the speaker) was still a firm believer in business affairs in that part of the world. They all knew what England and her Allies were going to do. The proprietors sympathized with the Directors in the trying circumstances in which they were situated.

Mr. J. L. CHAPMAN seconded the proposal; and the CHAIRMAN'S acknowledgment brought the meeting to a close.

STALYBRIDGE GAS-WORKS RESULTS.

Removing a Misapprehension.

After the minutes of the Gas Committee had been submitted to the monthly meeting of the Stalybridge Town Council last week, Mr. J. STORRS (Chairman of the Finance Committee) said he would make an explanation. He did not know whether he was correctly reported or not in the observations he made on "budget night;" but if he was, he must have conveyed an impression that was somewhat misleading, and which he did not intend. The report said that for three years there had been no profits from the gas-works.* He did not mean that there had been three years, but that this was the third year. To the best of his recollection, he said the Gas Committee had lost last year, that they were £500 short the year before, and that they were entering upon a year now that the Gas Committee admitted would not be remunerative. He meant to say that they were now entering upon a third year, and not that they had passed through three years, in which there had been no profit. So far as the minutes were concerned, he thought the Gas Committee had made a mistake in only increasing the price of gas 3d. Last year the Gas Committee lost £960; and it was admitted that the price of coal had very materially increased for the present year as against last year. He did not want to put on anything that would make a large profit from the gas-works; but he thought they were passing through such a period at present that the price of gas ought to be sufficient to pay the cost of production. In order to test the feeling of the Council, he moved that the minutes pass with the exception of that relating to the price of gas; and that this be referred back for further consideration.

There was no seconder.

Mr. COOK (the Chairman of the Gas Committee) said the policy of only increasing the price 3d. was decided upon after very careful discussion. If they found later on in the year that they would not be able to get along, they could increase the price again. He thought the gas consumer was entitled to consideration at this time. During the last ten years £24,000 had been paid by the Gas Committee in subsidies to the rates. This last year was the first year there had been a loss for the last ten years. Before the war commenced their consumption of gas was increasing gradually; but during the first three or four months of the war they lost 14,000,000 cubic feet in consumption, and this cost the Gas Committee about £1000. They also lost a big sum on the sale of coke and other residuals. For the coming year the price of coal would be up 50 per cent. Fortunately they had 6000 tons ready bought; and they had to buy another 10,000 tons at 6s. up. In 1913 the Committee gave £2000 to the relief of the rates, in 1914 £1500, and this year nothing. The £500 which had been referred to as a loss was only a loss on estimate, and not on the working of the undertaking.

Mr. STORRS said he had explained what his position was. If he remembered rightly what he said in introducing the estimates was that this was the third year they were entering upon that the Chairman of the Finance Committee had had to deal with a loss. Of course, the loss of £500 which was carried forward was admittedly a depreciation on the amount of the estimated profit; and it was in view of the variations in the estimates that they decided to alter the policy of estimating what the profit would be. On his first introduction of the estimates two years ago, he was faced with a deficit of £500, the past year had resulted in a loss of £950, and they were now beginning on what he stated to be the third year in which, as Chairman of the Finance Committee, he had a loss instead of a profit to deal with.

Mr. COOK (continuing) pointed out that in 1890 the total rates and taxes for the gas-works were £437; in 1915, they were £1972. This was one place where the profits were going. In addition, this year they were faced with a contribution for those on military service of nearly £600. He said advisedly that this question ought to be reconsidered. "We have one man who left the gas-works," proceeded Mr. Cook, "who was very useful; and his place has had to be taken by somebody, otherwise the gas-works could not run on. That man has eight children. If anything happened to him those eight children would have to be kept by the country; and rather than let men of that description go, and probably single young men take their places, I think we ought to discourage men of that sort and help to persuade others with less responsibility on their shoulders. I think before we let anybody else go from this Corporation, the circumstances ought to be taken into consideration. In the case I have quoted, the Government and gas-works are paying 50s. per week, of which 19s. 3d. is from the Gas Department."

* The statement referred to was reproduced on p. 296 of the "JOURNAL" for the 4th inst.—ED. J.G.L.

The minutes which were adopted stated that at the Gas Committee meeting on April 20, the Chairman presented a report on the gas-works accounts for the past year, which showed a loss of £961; and it was resolved that the price of gas be increased 3d. per 1000 cubic feet as from March 25 last.

NOTTINGHAM GAS REVENUE.

Increased Prices Foreshadowed.

When the Nottingham City Council, at their meeting on Monday of last week, were faced with the necessity of increasing the already heavy municipal rate by 5d. in the pound—making it 6s. 11d. exclusive of poor law charges—there was one satisfaction forthcoming that the chief local public undertaking had not failed in its ability to maintain its contribution in relief of rates at the same high level as last year. Of the £71,000 which it was decided to allocate from the profits of the Corporation's three main revenue-earning businesses, no less than £39,000 was again to be taken from gas; £22,500 being derived from tramways, and £9500 from electricity. A note of warning was, however, sounded as to future charges for gas; it being clearly indicated, in face of an estimated increase in next year's coal bill to the extent of £50,000, that a revision of the present rates charged to consumers may have to be undertaken in the near future.

Alderman A. BALL, the Chairman of the Committee, in moving the adoption of the annual report [see "JOURNAL" last week, p. 346], was eulogistic of Mr. John Wilkinson's excellent management, and the loyalty with which he had been supported by his staff rendering such gratifying results possible. A strong position in relation to the undertaking had been brought about through improved manufacture and the largely increased amount of gas per ton of coal carbonized. The Committee were following a very safe policy in making ample provision for renewals out of revenue. At the present time they had entered into a contract with the Woodall-Duckham Company for over £60,000 for an installation of new retorts at the Basford works. This was a sound business arrangement, as they were making provision for renewals from their profits from year to year. During the past twelve months the Committee had had to contend with some serious difficulties. The pitch market had been dead-against them, and the consumption of gas had gone down very materially since the war broke out; otherwise they would have had a record year. Up to August, the increased consumption of gas amounted locally to over 60 million cubic feet; but since that time to the end of the financial year they had not only lost this 60 millions increase, but were down 70 million cubic feet compared with last year. The strong position attained in connection with the undertaking was due to better carbonizing results. In 1910, 10,692 cubic feet of gas were sold per ton of coal carbonized; last year, the proportion was 11,675 cubic feet. In 1910, 7·15 cwt. of coke was sold per ton of coal carbonized, as against 8·82 cwt. this year. These two items alone were responsible to a very large extent for the present position of the undertaking. They were now faced with huge difficulties regarding coal supply. The Committee in their wisdom had hitherto bought well forward, but had experienced great difficulty in getting deliveries under their old contracts. It was impossible at the present moment to place any new contracts at less than 5s. a ton advance. Some colliery proprietors were asking for a larger increase than this. If the increased price of coal was taken at 5s. per ton, it meant an enhanced cost to the Committee of £50,000 for next year. As against this, they obtained only 17s. a ton for pitch last year, compared with 44s. in 1913; so that these two items alone would make a difference of something like £56,000 to the gas undertaking in the ensuing year. He was very much afraid, therefore, that the Committee would be compelled during the next year to increase the price of gas. Personally, he could see no alternative to the adoption of this course. Other large gas undertakings throughout the country had already raised their prices—in some cases by as much as 8d. per 1000 cubic feet. He did not think that in Nottingham the price would be increased to anything like this extent. The management were doing all that was possible to get the utmost out of the undertaking. Last year the salary of the Gas Engineer was

increased; and he thought they did the right thing, for the results had merited the increase granted to Mr. Wilkinson. After referring to the good work of the Accountant (Mr. Garton) and his department, Alderman Ball expressed the opinion that the report would be found one of the best in the history of the undertaking.

Mr. GOVER FORD (the Vice-Chairman of the Committee) seconded the adoption of the report, expressing his cordial agreement with everything that had been said by Alderman Ball regarding the Engineer and others connected with the undertaking. At the same time, there had been no reference to one to whose untiring services the city owed so much in relation to the gas concern. In Alderman Ball they had a Chairman who put in a tremendous amount of time and energy to bring the undertaking to a successful issue. He thought there should be added to the resolution an expression of the Council's indebtedness to him.

This suggestion was heartily adopted in the passing of the resolution in relation to the report.

SOUTHPORT UNDERTAKINGS AND THE RATES.

A Special Meeting of the Southport Town Council was held last Wednesday evening, for the purpose of levying a rate for the current year.

The BOROUGH TREASURER (Mr. George Lloyd), in his report, pointed out that last year a rate of 5s. in the pound was levied. Consequent on the restriction of lighting, a considerable saving was naturally to be expected, particularly in regard to gas. He estimated that an increase of 5d. in the rate would be necessary; and among the causes which had brought about this increase were the following: The Gas Estate last year was asked to contribute £14,000 in relief of rates. As the profit was only £13,000, it was short by £1000. The proposal this year, having regard to the great uncertainty, particularly with respect to the price of coal, is to contribute £10,000. This leaves £4000 to be met out of the rates, equivalent to 2d. in the pound. The Water Board precept last year was £11,232. The estimate advised for this year is £12,980, an increase of £1748, equal to a rate of ¾d. in the pound.

ALDERMAN WINTERBOTTOM (the Chairman of the Finance Committee) submitted the recommendations of his Committee, which were an increase in the rate of 3d. in the pound, and the levying of a war rate of 10 per cent. on the charges for gas and electricity to operate from Midsummer. He said the great increase in the price of coal had seriously affected the gas and electricity undertakings; and this, with a decrease in the value of residuals from the gas-works, was responsible for 2d. in the pound. The two Committees concerned agreed to the proposal he had made.

Mr. HOULDSWORTH moved an amendment that no increase be made in the price of gas and electricity, but that the rates should be further raised. He said he did not think it fair that the gas consumers of Southport should help to contribute to the rates of those who did not consume gas and electricity. In the Ainsdale area there were no electricity consumers, and in Birkdale (recently amalgamated with Southport) electricity was supplied by a private company; so that the 10 per cent. did not affect them. If the Gas Estate could be worked to produce a profit of £4000 a year without increasing the present charge for gas, that was sufficient to take from the pockets of gas consumers. It would be more equitable to put a special rate on and leave the price of gas as at present—2s. 6d. per 1000 cubic feet.

Mr. CRANKSHAW seconded, and said cheaper gas was the only privilege Ainsdale had had since amalgamation.

Mr. RICHARDSON (the Chairman of the Gas Committee) said he opposed the amendment in the interests of the small consumers. If the price of gas and electricity was not increased, the rates would have to be further raised; and this would mean that the rents would be increased. When the rents were put up, they were never decreased. On the other hand, when the price of coal came down the 10 per cent. would come off. The small consumer, therefore, would get the benefit in the long run.

Mr. SPEIRS pointed out that the poor people could economize in the use of gas where they could not in the matter of the rates.

The amendment was defeated by a large majority—only the mover and seconder voting for it. The proposals of the Finance Committee were then agreed to.

The total rates (including 9d. poor-rate) are now 6s. in the pound—the highest in the history of the borough.

BRADFORD GAS AND WATER UNDERTAKINGS.

Profits and the Rates.

Financial matters were considered, at length, at a meeting of the Bradford City Council last Tuesday, when the reasons were given for the increase of 6d. in the pound on the rates which had been found necessary.

Mr. JAMES HILL (the Chairman of the Finance and General Purposes Committee), in the course of his statement, said the budget was necessarily affected in many ways by the tragedy which was being enacted almost within sound of our shores. However, from the point of view of the Municipality, there was much cause for thankfulness that the trade depression which in the early stages of the war seemed inevitable had passed away. Bradford had every reason to be proud of the municipal ownership of its monopoly trading concerns. He did not think these trading undertakings should be run for the sake of making profit to relieve rates; but there was full justification for a reasonable contribution to rate aid, and every party in the Council had approved the principle of utilizing profits so as to avoid undesirable fluctuations in rate poundage. In the dark days in the early part of the war, their undertakings, in common with others throughout the country, suffered a considerable check; and it was gratifying that, with the exception of the gas-works and conditioning house, the undertakings had so far recovered as to show a profit for the year. The sale of water for trade purposes showed a diminution of £3000 upon the previous year. Payment of rates had cost £650 more, while the interest charges had increased by £3200. The scheme of equation of loans, however, gave the Council a comparative saving in sinking fund charges of £2200; and there was an approximate net profit for the year of £5800, as compared with £10,800. The undertaking had a credit balance on March 31 of £23,200; and from this he proposed to utilize in relief of rates the sum of £7000, leaving £16,200 to be carried forward. During the year £66,000 had been spent upon the extension of the water undertaking. As to the gas-works, the undertaking had suffered financial disability in various directions. The sales of gas had been less than in the previous year by a sum of £2000; the income from residuals had dropped by no less than £22,000; and the undertaking showed a loss for the year of £27,000, compared with a loss the previous year of £800. In view of the difficulty which the Committee were experiencing in obtaining sufficient supplies of coal, and the largely enhanced cost, there was no apparent alternative to an increase in the price at which the gas was sold. The gas-works had a splendid history; and he was quite sure that the present cloud, produced by very exceptional circumstances, would not remain beyond the period of the war. There was at the beginning of the year a credit balance on revenue account of £21,700, from which there was appropriated in relief of rate £5000, leaving £16,700. Taking the deficit for the past year at £27,000, this left a revenue debit balance of £10,300. The restoration reserve fund of £25,000, however, had not been disturbed; so that there was still standing to the credit of the undertaking a net revenue balance of £15,000. In view of the loss on the year's working, he did not, of course, propose to take anything from the gas-works in relief of this year's rates.

GERMAN SULPHATE OF AMMONIA ASSOCIATION.

[From the "Iron and Coal Trades Review," May 14.]

The report of the Deutsche Ammoniak Verkaufs Vereinigung of Bochum for 1914 states that the year opened with prospects not too favourable for the sale of ammonia. Notwithstanding a considerable reduction in prices by the Association towards the close of 1913, large quantities remained undisposed of at the end of the period of consumption—that is, in the spring of 1914. The production of sulphate of ammonia had advanced in recent years by leaps and bounds, and it should experience a further large expansion through the synthetic process which had been improved to a practical stage of working. In the export markets, British competition was keen, and, in addition, large offers were everywhere made of other nitrogenous fertilizers—Chilean and Norwegian nitrate, as well as cyanamide.

Though at the beginning of 1914 Japan, and particularly America, contrary to expectation, appeared as buyers of considerable quantities at the last moment, these purchases did not result in any perceptible strengthening of the market. Under these circumstances, the British quotations assumed a downward movement immediately from the opening of the year, and fell from £12 3s. at the beginning of January to £10 3s. at the end of May, though the foreign deliveries of the Association in this period only increased by 29,000 tons to 67,000 tons; the quantity in the corresponding months of 1913 having been 38,000 tons. During the ensuing months, and despite the low prices, the export market showed itself but little capable of consumption; and Great Britain therefore proceeded to contest business with the Association in the German home market at largely reduced prices. Certainly these endeavours were prejudiced through the contractual agreements of the Association with a large number of home consumers. But they produced uncertainty, so that, when a considerable fall took place in the nitrogen market, and especially in nitrate prices, it appeared advisable to the Association and its syndicated friends to make fresh material reductions in prices in the course of the summer, so as to secure the autumn business. The situation of the market was at first but little influenced through the outbreak of the war at the beginning of August. The demand for sulphate of ammonia soon became brisk; and, as a consequence, prices made such an advance that the Government intervened to fix a maximum.

In external markets, especially in Great Britain, the conditions at the beginning of the war remained highly uncertain. The Association was prevented from effecting deliveries abroad through "the prohibition imposed on exports by the German Government last September, and it was compelled to dissolve the contracts then current with America and other countries." The export business of the Association had given promise of a large increase. The Association had sold 155,500 tons for export, as compared with 66,000 tons in 1913. Business developed in particular with the United States, which would have been a prominent market in the future, unless Germany should be able to absorb the whole of the inland production.

The inland sales of the Association in the months of January to July inclusive amounted to 191,062 tons, as contrasted with 173,856 tons in the corresponding period of 1913; and in the succeeding five months the quantity was 130,342 tons, against 78,067 tons—being totals of 321,404 tons and 251,923 tons respectively in the two years. The total deliveries for the account of the Association in 1914 reached 406,476 tons, which were produced by the constituent members, against 324,280 tons in 1913; while, as a further quantity of 7361 tons, compared with 10,952 tons in 1913, was sold for four associated works, the aggregate for last year amounted to 413,837 tons, as contrasted with 335,232 tons in 1913. In addition 893 tons of ammoniacal liquor were disposed of in 1914, against 2620 tons in the preceding year.

In conclusion, the report states that, notwithstanding the interruptions which have been produced by the war complications, the Association has resolved to maintain the activity of its foreign offices as far as possible, in order to extend and strengthen the possibilities of sales after the conclusion of peace.

Sale of the Ingleton Gas-Works.—At a recent meeting of shareholders in the Ingleton Gas Company, it was decided to dispose of the plant as a going concern to Mr. Henry Ellison, of Heckmondwike. The price is stated to be about £700.

SCOTTISH PROVISIONAL ORDER INQUIRIES.

Lanarkshire Gas and Water Order.

An inquiry was recently opened in Edinburgh, under the Private Legislation Procedure (Scotland) Act, into certain Provisional Orders for which application has been made. The Commissioners were Mr. Ainsworth, M.P., who presided, the Earl of Galloway, Lord Ashton of Hyde, and Mr. Wilkie, M.P. There are three Orders for consideration, and the Commissioners took first that promoted by the Lanarkshire County Council and the District Committee of the Middle Ward to obtain powers (*inter alia*) in respect of the gas and water supply.

By the Lanarkshire Gas Order of last year, the Burghs Gas Supply (Scotland) Act, 1876, was, in relation to the county, amended in various respects with a view to enabling the Act to be adopted and carried into effect within the county, as contemplated by section 44 of the Local Government (Scotland) Act, 1894. By section 9 of the Act of 1876, the town councils of two or more burghs who have adopted the Act are authorized to amalgamate for the purposes of the supply of gas; and the Order makes provision for the combination of two or more special lighting districts or other areas in the county in which the Act may have been adopted.

The District Committee require power to make a railway more than three miles long, commencing by a junction with the Caledonian Railway Company's main line from Glasgow to Carlisle, and terminating near the embankment of the reservoir on the Camps Water. Portions of the parishes of Cumbernauld and Kirkintilloch are without a water supply; and it is stated that they can be efficiently and economically supplied by the Committee. At the request of the Dumbarton County Council and the Eastern District Committee of that county, the Council and the Middle Ward Committee have agreed to the inclusion of the parishes within their limits of supply; and confirmation of the agreement is sought. The Middle Ward Committee seek authority to construct additional water-works for the purpose of affording a supply within the area referred to, and for improving the means of supply within the existing limits of the Committee.

Something like a hundred objections had been lodged to various parts of the Order as it was first drafted; but, by the exercise of a little reasonableness on both sides, the opposition had to a great extent disappeared, except with regard to the extension of the water limits. The promoters are able to supply the new area; and its necessities are undoubted. It was stated, in the course of the proceedings, that the inhabitants of the area concerned had been simply "shouting" for water for twenty or thirty years, but had been unable to obtain a satisfactory supply. Now the inclusion of parts of the parishes of Cumbernauld and Kirkintilloch was opposed by the North British and Caledonian Railway Companies, on the ground that the area selected contained more railway lines than were reasonable; and they submitted that districts through which the railways run on the north and southeast of the area should be excluded from the scheme, and not be liable to assessment for water. The Dullatur Water Company, who are able to supply only a very small proportion of the area's requirements, also wished to be excluded.

The inquiry occupied three days, with the result that the Dullatur opposition was settled, and the promoters consented to the insertion of a clause providing for the revision every twenty years, by the Local Government Board, failing agreement, of the rates and charges in the new area. The preamble of the Order was declared proved, subject to the insertion of a rating clause proposed by the Commissioners. With regard to the revision of the excess charges for water in the new area, the Commissioners desired the insertion of a provision to the effect that the promoters would not oppose the future transfer of the water supply (except on the question of price) to the Dumbarton County Council, if they so desired. The Chairman remarked that since the decision of the Commissioners might be referred to as a precedent, they desired to say that they strongly approved of the general rule that a local authority, chosen by the ratepayers, and responsible for the public health, should in every case supply water within their own area. They were prepared to sanction this case as an exception, on the strong recommendation of both the local authorities interested. They further thought that where such a plan was necessary, the supplying local authority ought not to make a profit. Sir Thomas Munro, the County Clerk and County Treasurer of Lanarkshire, on behalf of the promoters, stated that they were prepared to carry out these suggestions of the Commissioners.

Irvine Water Schemes.

The inquiry was continued in Glasgow on the 30th ult. and the following day, when the Commissioners had before them two Orders promoted by the Irvine and District Water Board—one for power to construct a new reservoir on Knockendon from the waters of Drum Burn, in the parishes of Dalry and West Kilbride; and the other being in the nature of an emergency scheme for securing temporarily from the Camphill reservoir of the Paisley Corporation a supply of water by means of a conduit laid from there to the Greenhead filters in Stevenston parish. The first Order was opposed by Lord Kelburne and Mr. Graham, of Crosbie Castle, West Kilbride, on the ground that the proposed extension interfered with the amenity of their estates and the sporting rights, and that the extension was not necessary; also by the Caledonian Railway Company and the Lanarkshire and Ayrshire Railway Company, on the ground that it would alter their assessments in the area. The Companies likewise raised the question of their right to aggregate their assessments within the Water Board's area. The emergency Order was opposed only by Lord Kelburne. After hearing evidence and statements by Counsel, the Commissioners found the preamble proved in both Orders, subject to the adjustment of clauses. They did not propose to insert an aggregation clause, and did not express any opinion at the moment on the merits of the general principle. With regard to sporting rights, they would approve of a clause on the lines of the Lanarkshire precedent.

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NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

The Gas Committee of the Glasgow Corporation are recommending that the sum set aside for depreciation of the works and plant for the year to May 31, 1915, should be £20,136, compared with £78,155 for the preceding year.

The Engineers of the Edinburgh Water Trust have investigated a complaint in regard to the quality of water supplied to the Inverleith district, and have reported that the trouble is due to the use of galvanized iron pipes and to the softness of the water, which set up some kind of electrolytic action not fully comprehended by chemists. No chemicals of any sort were added to the water. The Engineers have advised that no galvanized iron pipes should be used.

A case which should serve to emphasize the necessity for obscuring all lights visible from the sea has just been dealt with by Sheriff-Substitute Orr in the Edinburgh Sheriff Summary Court, when Ernest Valvona, an ice-cream dealer at 26, Promenade, Portobello, pleaded guilty to a charge of having, between one hour after sunset and one hour before sunrise, on the 19th, 20th, 27th, and 28th of April, in the shop occupied by him, failed to obscure the lights therein, so as to be unseen from the outside—such lights, if unobscured, being visible from the sea—contrary to the Defence of the Realm Act, 1914. The Sheriff said he thought that at this time of day it was exceedingly bad to find shopkeepers and people who knew the regulations calmly going on disregarding them, and having to be brought to the Court. He imposed a fine of 10s.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *May* 17.

There is no new feature to report in the London tar products market. Pitch freights are certainly easier again; but as the shipping season is practically over, little advantage can be taken of reduced freights. It is understood that pitch stocks abroad are exceptionally small; so it may be expected that shipments will be resumed at the earliest possible time after the hot weather. Delivery instructions in large quantities are coming in for tar and pitch for road work.

Sulphate of ammonia is in strong demand, and the minimum prices are £13 7s. 6d. net for May-June, and £13 5s. net for July-December delivery, for 25 per cent. quality, filled into buyers' bags at makers' works.

Tar Products in the Provinces.

May 17.

There is no alteration in the markets for tar products; but on the whole prices remain steady. The demand for pitch has quietened down somewhat. Benzols are firm, and there is a fair amount of inquiry. Solvent and heavy naphthas are in very good demand. Creosote is quiet, and business is reported at reasonable prices. Crude carbolic remains the same.

The average values of gas-works products during the past week were: Gas-works coal tar, 21s. 3d. to 25s. 3d. Pitch, East Coast, 21s. to 22s.; Norfolk, Suffolk, and Humber ports, 18s. to 19s. per ton; West Coast, 19s. to 20s. Manchester; 20s. to 20s. 6d. Liverpool; 23s. to 24s. Clyde. Benzol, 90 per cent., naked, North, 10½d. to 11d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 2d. to 2s. 4d. Crude naphtha, in bulk, North, 5½d. to 5⅝d. Solvent naphtha, naked, North, 1s. 7d. to 1s. 8d. Heavy naphtha, naked, North, 11d. to 1s. Creosote, in bulk, North, 3d. to 3¼d. Heavy oils, in bulk, 3⅜d. to 4d. Carbolic acid, casks included, 60 per cent., East and West Coasts, 3s. 4d. to 3s. 5d. Naphthalene, £8 to £16; salts, 75s. to 85s., bags included. Anthracene, "A" quality, 2d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *May* 15.

Throughout the week the market for this article has remained very firm, and higher prices have again been realized at all the principal ports. There has been a good demand from direct buyers as well as from middlemen, who have both paid more money in order to cover their requirements. The nearest values at the close are £13 15s. per ton f.o.b. Hull, £13 15s. 3d. per ton f.o.b. Liverpool, and £13 18s. 9d. per ton f.o.b. Leith. A fair amount of business has been transacted in the forward position, and it has transpired that £13 17s. 6d. per ton f.o.b. good port has been obtained by makers for July-December delivery in equal monthly quantities.

Nitrate of Soda.

This market has not been quite so firm, and spot quotations have been reduced to 12s. 10½d. for ordinary, and 13s. 1½d. for refined quality.

Sulphate of Ammonia.

From another source it is reported that there has been a little more inquiry for this article during the past week, and prices have improved slightly at some ports. Outside London, makes are quoted at £12 17s. 6d.; Hull, £13 10s.; Liverpool, £13 10s. to £13 12s. 6d.; Middlesbrough, £13 12s. 6d.; Leith, £13 12s. 6d. to £13 15s.

Bolton Gas Prices.—A special conference of the Finance, Gas, and Electricity Committees has been called to consider the question of the revision of the charges for gas and electricity at Bolton. At their last meeting, the Gas Committee decided to hand over £15,000 in aid of the rates, with £3000 for renewal funds.

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COAL TRADE REPORT.

Northern Coal Trade.

The northern coal trade is more settled, now that the method of working the system of licensing of exports of coal to neutrals is becoming known. Coals seem to be in ample supply at present, though the approaching holiday may make coal more scarce. In the steam coal trade, best Northumbrians are about 24s. to 25s. per ton f.o.b.; second-class steams are about 22s. per ton; and steam smalls are steady at 14s. 6d. to 17s. per ton f.o.b., according to quality. A number of contracts for steam coals are in the market, and one for the Norwegian State railways is fixed for some 45,000 tons of best steams at near 25s. per ton f.o.b., delivery over the next four months. In the gas coal trade, there is rather more demand for both prompt and forward delivery. Best Durham gas coals are 23s. 6d. per ton f.o.b.; second-class gas coals are from 21s. 6d. to 22s. 6d. per ton; and "Wear Specials" from 24s. per ton f.o.b. A larger part of the gas coal is shipped to France and to home ports than steam coals, so that gas coal does not seem to be quite as much affected by the licence system as the other class; but much of the gas coal is on contracts that are still low in price. Advances of wages of 15 per cent. in Durham and Northumberland have come into force, and will stiffen the price, though they preclude further rises of the wages of the miners for some time to come. In the coke trade, the market is firm. Gas-house coke is now not so plentiful—the output being less. For good gas coke, from 19s. to 20s. 6d. f.o.b. is now the current quotation. The retail price has been slightly raised at some inland centres.

Stafford Municipal Undertakings.

The Stafford Town Council have had before them the annual reports of their several trading undertakings for the year ended March 31. As to the Gas Department, the accounts show a net profit of £2799. The make of gas per ton of coal carbonized was 11,481 cubic feet; the amount unaccounted for working out at 2·46 per cent. The net proceeds of residuals equalled 57·04 per cent. on the cost of coal, &c. The quantity of gas sold was 244,484,870 cubic feet. The Committee recommended that £1500 be handed over to the district fund. From the electricity works there is a gross profit of £3531, and a net profit of £226; the percentage of total expenditure to gross revenue being 50·9. The report of the Water Committee recorded the year's working as satisfactory; the gross profit being £4572. After deducting charges, the Committee proposed to allocate £1250 in aid of the general district rate. Alderman Westhead said that, all things considered, they had had a better time than was foreshadowed. If the Gas Committee had considered their own convenience, and the advantages of the department, they would not have paid over anything to the district fund this year; but they thought they would be best serving the interests of the ratepayers by doing what they proposed.

Charge for Unused Electricity at Yarmouth.

At the last monthly meeting of the Great Yarmouth Town Council, Mr. Williment called attention to an account passed by the General Purposes Committee of £921 11s 2d., less £329 18s. rebate—making £591 12s. 4d.—for public lighting. The Accountant told them that an arrangement had been entered into provisionally by the Chairmen of the Electricity and General Purposes Committees that a certain charge should be made to the Council for the use of electricity for public lighting. It appeared from the statement made at the Committee meeting that the Council were to pay 60 per cent. of the usual charges, with the object of covering capital charges. Whether or not they used any light they were to pay 60 per cent. This appeared to him to be a most extraordinary arrangement, and it had never been brought before the General Purposes Committee. He did not see why the Council should be treated differently from a private consumer. The whole of the £591 would go towards the capital charges of the undertaking out of the ratepayers' pockets; and he contended that it was an unjust charge. He moved that the matter be referred back to the Committee for consideration, as should have been done in the first instance. Mr. Harbord, who seconded the motion, said if this 60 per cent. was to be paid it should be allocated towards the cost of laying mains for the extension of the public lighting. Only certain portions of the town were lighted by electricity, and they were hampered in the matter of the extensions by want of capital. Mr. Bellamy said he did not think the Electricity Committee would mind the matter going back; but the Council were altogether different from a private consumer, as the Committee expended £25,000 upon laying mains, &c., for street lighting, and this capital was lying idle at the present time. The motion was agreed to.

Mossley Gas Charges.—An increase in the price of gas is anticipated at Mossley, judging by the remarks of local officials at various recent meetings. For the last two years, it is pointed out, there have been losses on the undertaking, and the year just closed showed a net loss of £420. On the previous year there was a loss of £1016. Although there has been a loss on the year, gas-rentals have increased by £1424, attributable to the increased consumption. Against this, however, the sales of residuals show a decrease of £1163 compared with last year.

Yeovil Gas Undertaking.—The Chairman of the Gas Committee of the Yeovil Corporation (Mr. G. Gould) has presented his report on the undertaking for the year ended the 31st of March. The revenue amounted to £17,539, and the expenditure to £12,941; leaving a balance of £4598. But after payment of interest on capital, the instalment of principal, and income-tax, there is an adverse balance of £241, which is explained to have been caused by the advance in the cost of all materials, especially coals, and increased wages. The make of gas was 89,080,000 cubic feet—an increase of 1·24 per cent. The production per ton of coal used was 11,760 cubic feet, of which 10,910 cubic feet were sold.

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Old Broad St., E.C.

Increases in Price.—Increases have been made in the price of gas at the following places: Alton, 6d.; Cambuslang, 8d.; Darwen, 8d.; Monaghan, Southam, Portrush, and Yeovil, 5d.

Nottingham Water Undertaking.—Fears that the incubus entailed by Nottingham's "white elephant," the Derwent Valley scheme, might occasion demands upon the City Exchequer were removed at the last Council meeting, by the statement that the Water Committee would not require to make any call upon the rates during the ensuing year. A position of very great difficulty entailed by the participation of Nottingham with other authorities in the scheme for tapping the Derbyshire waters has been surmounted by the exercise of considerable economy in other directions, and a careful revision of charges, allowing much additional revenue to be brought in for the undertaking.

Tees Valley Water Board.—At Middlesbrough, the report of the Tees Valley Water Board has been presented to the Corporations of Middlesbrough, Stockton, and Thornaby. The capital expenditure for the last six months was stated to have been £7246, bringing the total cost of the undertaking up to £2,897,671. The revenue account showed an income of £64,666, being a decrease of £1826 on the previous half year, and £3888 as compared with the same half of 1914. The balance carried to the net revenue account was £52,024, against £56,059 in the corresponding period. There was a balance to net revenue of £67,104, of which £48,000 was paid to the Corporations during the year, leaving £19,104 to carry forward.

Cape Town and District Gas Company.—The report for the year 1914, to be submitted at the meeting to-morrow, states that the result of the working is a profit of £17,653, which, with the sum of £1668 brought forward, makes a total of £19,321 to the credit of the profit and loss account. Out of this, debenture and debenture stock interest, paid and accrued to Dec. 31, has been provided. The sum of £1172 has been written off for depreciation of stocks on hand, and £6180 in respect of the balance of cost of the new retort installation, leaving a balance of £3286, out of which the Directors propose to pay a half-year's dividend on the preference shares, and to carry forward £1036. The first half of the year showed a satisfactory increase of business; but a general falling off resulted in the second half, through the abnormal conditions occasioned by the declaration of war. The Directors are of opinion that under war conditions a further reduction of the general demand for gas will have to be faced during the current year; but every possible attention will continue to be given to economical working, and it is hoped that the clearance which has been made of specially heavy expenditure out of revenue, coupled with improved conditions of manufacture, will fully counterbalance the unfavourable results arising from any such diminished demand. The new vertical retort installation was brought into partial use in July, and into full use in August, and has proved satisfactory. Completion of the contract should have been effected in November, 1913; but it was delayed for eight months after the due date, and the Company thereby suffered heavy expense and loss. The matter is at the present time a subject of negotiation between the Company and the Contractors.

The Air Raid on Southend.—During the recent air raid on Southend and the district, it is stated that seven bombs were dropped in the immediate vicinity of the Leigh Gas-Works. The nearest fell about 50 yards away from a holder. This incendiary bomb was a failure; and the others harmlessly burnt away in a field.

St. Pancras Public Gas Lighting.—The question of the present arrangement of public gas lighting in consequence of the war has been under the consideration of the Public Lighting Committee of the St. Pancras Borough Council. Only one-third of the lamps are now lit; and these are extinguished by 10 o'clock. As the lighter evenings have now commenced, there is scarcely any interval between the completion of the lighting and the commencement of the extinguishing of the lights. It therefore appears to the Committee that there is little utility in keeping the lamps in lighting; and they have recommended the Council not to light the gas-lamps for the next three months.

Nottingham Street Lighting.—The Lighting Committee of the Nottingham Corporation came in for some criticism at a recent meeting of the Council, for having spent last year £1205 in excess of their estimate; it being complained that the already difficult task of framing the municipal budget was rendered doubly irksome by such unauthorized action. The result, however, as far as experience was afforded before the present rigid war restrictions as to street illumination came into operation, has been all to the city's advantage; and in view of the vast improvement which has been effected in some of the principal thoroughfares by the installation of high-pressure lamps, Nottingham has benefited materially. There will be no need of complaint regarding excessive expenditure by the Committee as long as the war lasts; Nottingham having in many parts been reduced nightly of late to a state of almost complete darkness. It is estimated that £60 a week, at least, is being saved on the lighting bill; the Committee making ample reparation by reducing their demands for the ensuing year by £2275.

Women as Gas-Meter Inspectors.—Some objection was raised in the Ossett Town Council to a statement of the Gas Committee that they had authorized the engagement of women as meter inspectors, if the necessity should arise. Mr. Peace asked why women should be employed in this capacity, when there had been a reduction in the number of the men at the gas-works. Alderman Bentley, however, pointed out that it was not intended to engage women unless an actual necessity arose; and he added that the Committee were only acting on the same lines as had been adopted by other corporations. Mr. Robinson (the Chairman of the Gas Committee) said it was repugnant to him that women should be employed in the work suggested; but the circumstances were exceptional. It was true that the number of workmen had been reduced from 45 to 40; but Mr. Peace should realize that men who could dig trenches were not suitable for inspecting meters. The Corporation were pledged to take back all the men who joined the Colours; and it was desirable to fill their places with women who could be temporarily employed, rather than engage men who were at present in other occupations.

THE LARGEST GAS FURNACE BUSINESS IN THE COUNTRY.

The one firm who PERSONALLY USE Gas Furnaces as well as make them.

The Firm whose Apparatus enabled the Royal Mint to melt their metal with Gas and reduce their costs.

MANY OF OUR FURNACES MAY BE SEEN IN OPERATION, BY APPOINTMENT, AT

83, Nursery St., SHEFFIELD.

BRAYSHAW FURNACES & TOOLS, LTD

(ASSOCIATED WITH JOHN WRIGHT & EAGLE RANGE LTD., ESSEX WORKS, BIRMINGHAM.)

Works and Head Office: Mulberry Street, Hulme, *Branch Works:* Vernon Street, Longsight, } MANCHESTER.

Tar Dehydrating Plant for Clacton.—At their meeting last Wednesday, the Clacton District Council adopted a recommendation of the Gas and Water Committee that a tar dehydrating plant should be installed at the gas-works at a cost of £200.

South African Lighting Association.—In a circular signed by Mr. William Arnott (Manager) and Mr. E. M. Sterley (Secretary), the South African Lighting Association have notified consumers that, as from April 1, they have, owing to the greatly increased cost of imported English coal, which has been rising in price, and also to increased freight charges, been reluctantly compelled to advance the price for gas to 8s. 4d. per 1000 cubic feet—a rise of 5d. A discount of 7½ per cent. will be allowed off gas consumption on accounts paid within thirty days from the end of the quarter.

Bourne Gas Undertaking.—At a meeting of the Bourne Urban District Council last Tuesday, a report of the Gas Committee was adopted, recommending the acceptance of a tender for the supply of coal at 22s. 8d. per ton. As this was 5s. 6d. in excess of last year's price, the Committee estimated that a loss of £300 would occur on the year's working at the present prices for gas and coke. It was decided, therefore, upon their recommendation, that the price of gas be raised from July 1, 3d. per 1000 cubic feet, and that the rates charged for coke should be revised. The Finance Committee reported that the taxed costs in connection with obtaining a Provisional Order for taking over the gas undertaking amounted to £625; and it was resolved that the £275 borrowed for working capital should be used towards the payment of this amount, and that application be made for a further loan of £300.

Bideford Gas Company.—The annual meeting of the Bideford Gas Company was held last Thursday. The Chairman (Mr. F. A. Searle), in moving the adoption of the report, said the war had undoubtedly interfered with their profits; but their balance-sheet was a very satisfactory one. They had made a profit for the year of £1259, and other receipts brought the total to £1925. Though they charged 2s. 8d. per 1000 cubic feet for their gas, with the discount it worked out at 2s. 5d. net, which was as low as any town of its size in the country so distant from the coalfields. They had been having their coal on the old contract prices up to now; but during the coming year, owing to its largely increased cost at the works, amounting to 6s. per ton, the Directors felt compelled to put up the price of gas 4d. per 1000 feet. A dividend was declared of 13½ per cent. per annum on the original shares, and 10½ per cent. on the additional shares.

Improving the Conditions of Gas Workers.—Just over a year ago—on May 1, 1914—the Chairman (Alderman W. Kay), in the presence of the Manchester Corporation Gas Committee, formally opened a workmen's dining-room, &c., at the Bradford Road works; and the first annual report of the Workmen's Dining-Room Committee, which has now made its appearance, shows the gratifying success that has attended this praiseworthy effort on the part of the Committee to improve the conditions by which the gas workers are surrounded. The report states that during the year approximately 40,000 breakfasts, 20,000 dinners, 12,000 teas, and 10,000 suppers have been taken in the dining-room, a large proportion of these being either cooked or warmed in the kitchen. Suitable presents and greetings were sent at Christmas to comrades now serving with His Majesty's forces; a special fund being raised to augment the grant allocated for this purpose. The replies received in acknowledgment indicate that the gifts were heartily appreciated, and have proved very useful.

Brighouse Gas Department.—In his report to the Gas Committee on the working during the year ended March 31, Mr. H. Davies, the Gas Engineer and Manager to the Brighouse Corporation, says the output of gas from the works shows a decrease of 7,528,000 cubic feet, or 4·44 per cent.; and the gas sold, as per rentals, a decrease of 4,028,700 cubic feet, or 2·59 per cent. The unaccounted-for gas amounts to 8,977,300 cubic feet, or 5·55 per cent. of the output—a marked reduction upon previous years. The average consumption per annum per slot-meter is now 11,300 cubic feet; and these meters account for 20 per cent. of the gas produced. The average make of gas per ton of coal is 11,356 cubic feet, and the amount of gas sold per ton of coal is 10,643 cubic feet—a gratifying increase of 665 cubic feet, or 6·66 per cent. The yield of residuals has been good; but the returns from coke and tar have felt very considerably the effects of the market conditions, occasioned principally through the war. A large sum was spent during the past year in the renewal of certain portions of the plant.

"Still Going Up—How to Dodge the Coal Rise," is the title of a topical folder prepared by the Davis Gas-Stove Company, which is being well received by gas companies for distribution among their consumers. On the outside is a picture showing the rise in coal prices at different dates, and inside is a "Domestic Duologue," in the course of which the method of dodging the coal rise is revealed—use Davis cookers, fires, and circulators.

A statement made last week in answer to a question at a meeting of the Bradford City Council, showed that the number of Corporation employees who have enlisted for the war is 701, equal to about 10 per cent.; and of these 104 have been contributed by the Gas Department. So far as had been ascertained, 14 Corporation employees had been killed, 44 wounded, and about half-a-dozen are prisoners of war in Germany. Of the Gas Department, two are known to have been killed, and two wounded.

The United Gas-Mantle Company, Limited, has been registered with a capital of £20,000, in £1 shares, to manufacture gas-mantles on a large scale in a factory to be situated at Willesden. The Company have made arrangements with the vendor, Mr. W. G. Field, for the transfer to them of his option to purchase the land for the factory, and for its erection under his supervision. It will be capable of turning out about 6 million mantles annually; and the vendor will supply all the thorium required for the first twelve months. The new Company are issuing half the capital, at par. The first Directors are the Hon. Sir John Taverner, K.C.M.G. (Chairman), Mr. E. H. H. Bartlett, and Mr. R. Wilks. The Secretary is Mr. H. C. Backway; and the registered offices are at 107, Cannon Street, E.C.

Gas Showrooms

THE planning and equipment of the Gas Showroom is now a highly specialized branch of decorative art, which should be entrusted only to those who are experienced in the work.

The Nautilus Co., Ltd.

(Owned by The Davis Gas Stove Co., Ltd.)

were exclusively responsible for the many attractive features to be seen at the

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60, Oxford Street, London, W.,

and as a direct result have recently been entrusted with important schemes for the following:—

The Derby Gas-Light & Coke Company

The Kidderminster Gas Company

Other companies contemplating modernization should therefore write for Nautilus Plans, Specifications, and Estimates, which will be gladly submitted without obligation or fee.

* *Photographic Brochure Gratis.*

The Nautilus Co., Ltd.

(Proprietors: The Davis Gas Stove Co., Ltd.)
60, Oxford Street, London, W.

GAS COMPANIES IN THE STOCK EXCHANGE.

Some degree of improvement in feeling was apparent last week in many of the Stock Exchange markets. Not that there was any increase in the volume of bargains done, rather the reverse. But this is not always an unfavourable feature; for a moderate amount of business of good quality is better than a quantity of questionable stuff. A suggestion was made that business was quiet enough to warrant the closing of the Exchange on Saturdays [some 500 members have resigned in the current year], but this did not find much favour. But the closing of the London Clearing Banks at 3 (if adopted) is not likely to interfere much with business in Capel Court. The steady pressure and advance of the Allies on the Western front, and the adjustment of the Japan-China question, were ancillary to the improved tone of the markets. The Committee are handling the strong outburst of feeling produced by the "Lusitania" enormity with calm action and due deliberation. Business in the Gas Market was quieter like the rest. There was, however, no abatement in the general firmness; the prices realized being well up to the level reached in the preceding week, or a bit better in places. The Brentford Company are adopting the popular mode of raising capital by loans repayable at short dates, and invite applications for three, five, or seven year mortgages at 5 per cent. The Monte Video Company will pay a dividend on June 1, making 3 per cent. for the year 1914. The Money Market was unchanged.

Bargains done for cash during the week were as follows: On Monday, Gas Light Ordinary 89, 89¼, 89⅜, 90, ditto preference 87½, 87⅝, ditto debenture 69, Imperial Continental 83, Primitiva preference 4½. On Tuesday, Gas Light ordinary 89, 89¼, 89⅜, Liverpool 101⅜, South Metropolitan 91½, Wimbledon 113½, 114. On Wednesday, British 37, Gas Light preference 87½, 87⅜, South Metropolitan 94¼. On Thursday, Bournemouth "B" 13⅛, 13¼, Cape Town preference 4⅜, Gas Light ordinary 88⅜, 89, 89½, 89⅜, ditto debenture 68¼, 68½, Newcastle 92, South Metropolitan 94⅜, Wimbledon 113½, 114. On Friday, Bombay 5½, Gas Light ordinary 89, 89½, ditto maximum preference 87½, 87⅝, Imperial Continental 81¼, 81⅜, Liverpool 102, Primitiva 3½, South Metropolitan 94⅜, 95, 95½. On Saturday, Commercial 4 per cent. 94½, Gas Light ordinary 89, 89½, 89⅜, ditto maximum 69⅜, Primitiva 3¼.

Bank rate (fixed Aug. 8), 5 per cent.; last year, 3 per cent.

LOWEST AND HIGHEST PRICES OF BARGAINS DONE FOR CASH IN THE WEEK ENDING MAY 15.

Issue.	Share.	When ex Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices. July 30.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p c.		£ s. d.		
1,551,868	Stk.	April 8	2½	Alliance & Dublin Ord.	59 –64	3 18 2	..
374,000	,,	July 10	4	Do. 4 p.c. Deb.	76–79	5 1 3	..
280,000	5	April 29	7½	Bombay, Ltd. . . .	54–6⅜	5 17 8	£5
50,000	10	Feb 26	16	Bourne- 10 p.c. . .	29–30	5 6 8	..
878,480	10	,,	7	mouth Gas B 7 p.c. .	15–15½	4 10 4	13 1/16–13⅞
95,000	10	,,	6	and Water Pref. 6 p.c.	13½–14	4 5 9	..
—	—	—	—	Deb. . .	..	—	..
380,000	Stk.	Feb. 26	14	Brentford Consolidated	261–266	5 5 3	..
330,000	,,	,,	11	Do. New . . .	204–209	5 5 3	..
50,000	,,	,,	5	Do. 5 p.c. Pref. .	109–111	4 10 1	..
206,250	,,	June 11	4	Do. 4 p.c. Deb. .	91–93	4 6 0	..
217,380	Stk.	Feb. 26	11	Brighton & Hove Orig.	208–213	5 3 4	..
244,200	,,	,,	8	Do. A Ord. Stk. .	154–159	5 0 8	..
630,000	20	Mar. 26	12½	British	44–45	5 11 1	37
120,000	Stk.	June 26	4	Do. 4 p.c. Deb. Stk.	88–90	4 8 11	..
245,771	Stk.	June 26	4	Buenos Ayres 4 p.c. Deb.	85–87	4 12 0	..
100,000	10	—	—	Cape Town & Dis., Ltd.	1⅛–2⅛	—	..
100,000	10	—	—	Do. 4½ p.c. Pref. .	4–6	—	4⅜
100,000	Stk.	June 26	4½	Do. 4½ p.c. Deb. Stk.	70–75	6 0 0	..
157,150	Stk.	Feb. 26	5	Chester 5 p.c. Ord. . .	102–110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	Commercial 4 p.c. Stk.	106–108	5 1 2	91½
560,000	,,	,,	5½	Do. 3½ p.c. do. .	103–105	5 1 6	..
475,000	,,	June 11	3	Do. 3 p.c. Deb. Stk.	69½–71½	4 3 11	..
800 000	Stk.	,,	4	Continental Union, Ltd.	76–79	5 1 3	..
200 000	,,	,,	7	Do. 7 p.c. Pref.	115–118	5 18 8	..
—	—	—	—	Croydon B and C 7 p.c.	..	—	..
492,270	Stk.	—	6	Derby Con. Stk. . . .	123–125	4 16 0	..
55,000	,,	—	4	Do. Deb. Stk. .	102–104	3 16 11	..
1,002,180	10	July 29	10	European, Ltd. . . .	17⅛–18	5 11 1	..
16,362,910	Stk.	Feb. 12	1/17/4	Gas 4 p.c. Ord. . .	98–102	4 15 6	88⅜–90
2,600,000	,,	,,	3½	Light 3½ p.c. max. .	76–79	4 8 7	69⅜
4,062,235	,,	,,	4	and 4 p.c. Con. Pref.	96–99	4 0 10	87⅛–87⅜
4,674,850	,,	June 11	3	Coke 3 p.c. Con. Deb.	72½–74½	4 0 6	64½–69
130,000	,,	,,	10	10 p.c. Bonds .	..	—	..
258,740	Stk.	Mar. 12	6	Hastings & St. L 3½ p.c.	87–89	5 12 4	..
70,000	10	April 29	11	Hongkong & China, Ltd.	16⅛–16⅜	6 11 4	..
—	—	—	—	Hornsey 7 p.c. . . .	..	—	..
131,000	Stk.	Mar. 12	7½†	Ilford A and C . . .	151–154	5 2 4	..
65,780	,,	,,	6⅜†	Do. B	115–118	5 8 0	..
65,500	,,	June 26	4	Do. 4 p.c. Deb. . .	92–94	4 5 1	..
4,940,000	Stk.	May 14	9	Imperial Continental .	150–160	5 12 6	81½–83
1,235,000	Stk.	Feb. 12	3½	Do. 3½ p.c. Deb. Red.	84–86	4 1 5	..
200,242	Stk.	Mar. 12	6½	Lea Bridge Ord. 5 p.c. .	119–121	5 7 6	..
561,000	Stk.	Feb. 26	10	Liverpool 5 p.c. Ord. A	211–213	4 13 11	101¾–102
718,100	,,	,,	7		146–148	4 14 7	B
306,083	,,	June 26	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..

Issue.	Share.	When ex Dividend.	Dividend or Dividend & Bonus.	NAME	Closing Prices. July 30.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.			£ s. d.	
75,000	5	June 11	6	Malta & Mediterranean	½ –4⅜	5 9 9	..
250,000	100	April 1	4½	Met. of Melbourne 4½ p.c. Deb.	99—101	4 9 1	..
541,920	20	May 28	4	Monte Video, Ltd. . .	1½–2	6 13 4	..
1,775,892	Stk.	July 29	4½	Newc'tle&G'tesh'd Con.	92⅜—93½	4 10 6	12
529,705	Stk.	June 26	3½	Do 3½ p.c. Deb.	82 –84	4 4 10	..
55,940	10	Feb. 26	7 14 0	North Middlesex 7 p.c.	14—15	5 2 8	..
300.000	Stk.	May 14	8	Oriental, Ltd. . . .	117 –122	6 11 2	..
60,000	5	Mar. 26	10	Ottoman, Ltd. . . .	7½ –7⅝	6 9 0	..
60,000	50	Feb. 26	13	Portsea, Island B . .	128—13	4 19 3	..
100,000	50	,,	10	Do. C . .	118 –121	4 19 2	..
52,000	50	,,	10	Do. D . .	..	—	..
249,980	5	April 29	5	Primitiva Ord. . . .	5½ –6	6 18 4	7½–3½
499,960	5	June 26	5	,, 5 p.c. Pref. .	4½ –5	5 0 0	4½
521,600	100	June 2	4	,, 4 p.c. Deb. .	91 –93	4 6 0	..
—	—	—	—	,, ,, ,, 1911	..	—	..
346,193	Stk.	June 26	4	River Plate 4 p.c. Deb.	85 –87	4 12 0	..
150,000	10	May 14	6	San Paulo 6 p.c. Pref.	10½–11	6 9 1	..
125,000	50	July 1	5	5 p.c. Deb.	47 –49	5 2 0	..
135,000	Stk.	Mar. 12	10	Sheffield A	223—224	4 9 3	..
209,984	,,	,,	10	Do. B	222 –224	4 9 3	..
523,500	,,	,,	10	Do. C	220 –222	4 10 1	..
90,000	10	May 28	9	South African . . .	10½ –11½	7 16 6	..
6,429,835	Stk.	Feb. 12	5/9/4	South Met., 4 p.c. Ord.	111—113	4 16 8	91½ - 97½
1,895,445	,,	July 10	8	Do. 8 p.c. Deb.	72¾ –74½	4 0 6	..
209,820	Stk.	Feb. 26	8½	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	S'th Suburb'n Ord. 5 p.c.	114—116	5 3 5	..
60,000	,,	,,	5	Do. 5 p.c. Pref. .	110—112	4 9 3	..
—	—	—	—	Do. West Kent. .	..	—	..
137,058	,,	June 26	5	Do. 5 p.c. Deb. Stk.	116 –118	4 4 9	..
629,740	Stk.	May 14	5	Southampton Ord. . .	99 –102	4 18 0	..
120,000	Stk.	Feb. 12	7½†	Tottenham A 5 p.c. .	135—138	5 8 8	..
742,275	,,	,,	6†	District B 3½ p.c. .	115—117	5 2 7	..
181,255	,,	June 26	4	4 p.c. Deb.	87 –89	4 9 11	..
182,380	10	Dec. 30	5	Tuscan, Ltd. . . .	5 –6	6 6 8	..
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	93 –95	5 5 3	..
236,476	Stk.	Mar. 12	5	Tynemouth, 5 p.c. max.	108½ –109½	4 11 4	..
80,000	Stk.	Feb. 26	8⅜	Wandsworth, Wimbledon, and Epsom —			
255,636	,,	,,	6⅜	Wandsworth A 5 p.c.	151 –156	5 7 4	..
108,075	,,	,,	5 17/8	,, B 3½ p.c.	129 –134	5 2 7	..
354,000	,,	,,	6⅛	,, C 3½ p.c.	110 –115	5 2 0	..
98,000	,,	,,	6⅛	Wimbledon 5 p.c. .	117 –122	5 0 5	113½–114
88,416	,,	June 26	8	Epsom 5 p.c. . . .	121–126	5 5 2	..
				3 p.c. Deb. Stk. . .	66 –69	4 6 11	..

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

CHIEF ASSISTANT (GAS AND WATER), Barrow-in-Furness Corporation. Applications by May 17.
SUPERINTENDENT. Sheffield Gas Company. Applications by May 31.
SUPERINTENDENT OF WORKS. Lincoln Gas Department.
ASSISTANT-MANAGER. Grays and Tilbury Gas Company. Applications by May 21.
CHEMIST. No. 6035.
SHOW-ROOM ATTENDANT. Grays Gas-Works. Applications by May 22.
GAS-FITTERS. Sheerness Gas Company.
STOKERS. Sunbury-on-Thames Gas-Works.

Pupil Wanted.

COUNTRY WORKS. No. 6039.

Agency Wanted.

AUSTRALIA. No. 6038.

Plant, &c. (Second Hand), for Sale.

EXHAUSTER, ENGINES, AND TAR PUMP. Birmingham Union.
KEITH COMPRESSOR. J. Tucker and Co., Salford.
PURIFIERS, &c. Rothwell Gas Company.

Meeting.

INSTITUTION OF GAS ENGINEERS. Institution of Civil Engineers. June 1.

Sales of Stocks and Shares.

ALDERSHOT GAS, WATER, AND DISTRICT LIGHTING COMPANY. London Mart. June 1.
BOGNOR GASLIGHT COMPANY. London Mart. June 1.
SUTTON WATER COMPANY. London Mart. June 8.
WANDSWORTH, &c., GAS COMPANY. London Mart. June 15.
WIMBLEDON STOCK. J. R. Stamp, Coventry.

TENDERS FOR

Coal.

ACCRINGTON GAS AND WATER BOARD.
CHESTER GAS COMPANY.
DARLINGTON GAS DEPARTMENT. Tenders by May 21.
GLOUCESTER GASLIGHT COMPANY. Tenders by June 1.
LEEK GAS DEPARTMENT. Tenders by May 28.
LINCOLN GAS DEPARTMENT. Tenders by May 29.
NEWTOWNARDS GAS DEPARTMENT. Tenders by June 3.
OXFORD GASLIGHT COMPANY. Tenders by June 5.
RHYL URBAN DISTRICT COUNCIL. Tenders by June 1.
ROTHWELL GAS DEPARTMENT. Tenders by May 24.
SEDGLEY GAS DEPARTMENT. Tenders by May 28.
SKIPTON GAS DEPARTMENT. Tenders by May 29.
STOURBRIDGE GAS DEPARTMENT. Tenders by May 28.
STRETFORD GAS COMPANY. Tenders by May 20.
SUTTON-IN-ASHFIELD GAS DEPARTMENT. Tenders by May 31.

Coke.

SUTTON-IN-ASHFIELD GAS DEPARTMENT. Tenders by May 31.

Lamps.

CALCUTTA CORPORATION. Tenders by Sept. 20.

Lime.

LOUGHBOROUGH GAS DEPARTMENT.

Oxide.

BELFAST GAS DEPARTMENT. Tenders by May 27.

Sulphuric Acid.

LEEK GAS DEPARTMENT. Tenders by May 28.

Tar and Liquor.

LEEK GAS DEPARTMENT. Tenders by May 28.
LOUGHBOROUGH GAS DEPARTMENT. Tenders by June 6.
RHYL URBAN DISTRICT COUNCIL. Tenders by June 1.
SUTTON-IN-ASHFIELD GAS DEPARTMENT. Tenders by May 31.

The village of Rossington, near Doncaster, one of the centres of activity in the new coalfield extensions, has just obtained a gas supply, which is being provided by the Bawtry Gas Company. The village itself is new, and a creation of the coal industry.

Under the title of "Rubber Tar, Limited," a company has been formed, with a capital of £1050, in 1000 preference shares of £1 each, and a like number of ordinary shares of 1s. each, to carry on business as manufacturers of, and dealers in, chemicals and chemical products, tar and ammonia distillers, &c.

An excellent gas exhibition was opened at Swansea last Tuesday afternoon, by the Mayoress, who was introduced by the Chairman of the Gas Company (Mr. John Glasbrook). In a short speech, Mr. Glasbrook pointed out that it was some years since cookery lectures had been held under the auspices of the Company; and the present demonstration was held particularly to bring forward the claims of gas as against the existing high prices of coal. The Mayoress was given a pretty model of a gas-fire in aluminium; and in supporting a vote of thanks to her and the Mayor (Alderman Dan Jones), Mr. George Andrews emphasized the importance of knowing the most economical methods of using a gas-cooker, and thereby achieving the greatest possible saving.

The annual report of Mr. Barney, Inspector in charge of the gas-meter testing apparatus of the Middlesex County Council at Edmonton, shows that during the fifteen years the Sales of Gas Acts had been in operation in the county 1,194,698 meters had been tested, and fees amounting to £36,389 had been received.

The Directors of Meters Limited, reporting on the accounts for the year ended March 31, state that the trading has resulted in a gross profit of £30,382, which is reduced by general management expenses, Directors' fees, legal charges, expenses on patents, income-tax, and depreciation of buildings, machinery, and plant. A sum of £3738 has been spent out of revenue on repairs and renewals. After providing for interest on debenture stock, the net profit amounts to £21,441, which, with £2528 brought forward, makes £23,969, out of which interim dividends at the rate of 5½ per cent. per annum on the preference shares and 4 per cent. per annum on the ordinary shares were paid in November. The Directors now recommend the payment of further dividends at the rate of 5½ per cent. per annum upon the preference shares and 10 per cent. per annum upon the ordinary shares (making the ordinary dividend 7 per cent. for the year), that £3000 be added to the reserve fund (making the fund £103,000), and that the balance of £3450 be carried to next year's accounts.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

WHITSUNTIDE HOLIDAY.

In consequence of the WHITSUNTIDE HOLIDAY, Communications for the next issue of the "JOURNAL" and Orders respecting ADVERTISEMENTS should be received at the Office

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